THE AEROPLANE

Incorporating
Aeronautical Engineering
Edited by - - THURSTAN JAMES

Founder and First Editor
(1911-1939), C. G. GREY

Proprietors:
TEMPLE PRESS LIMITED
Chairman and
Managing Director:
ROLAND E. DANGERFIELD

Head Office:
BOWLING GREEN LANE,
LONDON, E.C.1.
Telephone: Terminus 3636
Telegrams:
"Pressimus London Telex."
Telex 23839

Vol. XCV. No. 2454 SEPTEMBER 12, 1958

Annual Subscription Rate: U.K. £4.15.0.
Overseas £5. Canada and U.S.A. $15.00

FARNBOROUGH IN RETROSPECT

WHEN all is said and done, and the final figures are studied and analysed, Britain's "aviation shop window" at Farnborough this year must come to be counted as one of the most successful to date. It was the nineteenth in the series to be organized by the Society of British Aircraft Constructors and eleventh to be held at the home of the Royal Aircraft Establishment. Last week we presented our first report of the Show's main attractions and in this issue we deal at greater length with the exhibits that were to be found inside and outside in the static display of accessories.

As our detailed reports show, the events at Farnborough last week were crowded with highlights. Few spectators, for example, can fail to have been impressed by the remarkable and stately aerobatics of the Victor and the Vulcan V-bombers. Nor will many forget the speed and agility of the supersonic Lightning; the quiet manœuvrability of our latest—and largest—helicopter; and the impressive steadiness of the World's first VTOL airliner. For sheer spectacular interest, however, there could be nothing to match the Service performances which included the impeccable Naval team with their Sea Hawks and the unbelievable precision of the 22 Hunters of the R.A.F.'s aerobatic teams—which on the final Sunday put up their finest show of the week.

So far as the less spectacular, but none the less important, technicalities of the static exhibition were concerned, there was more to see than ever before. And even though the heavy hand of Security had in so many cases succeeded in preventing all but the barest of facts from being stated, the mute exhibits themselves were not entirely unrevealing.

As had been expected quite a high proportion of the static displays were concerned in one way or another with electronics, and once again the point was extensively made that the electronics engineer and the aeronautical engineer are working close together. In fact, over the years there has gradually come into being an aviation electronics industry which now plays an intimate part in aeronautical developments. This industry, it has been authoritatively stated, has an annual output representing some £100 million worth of products —between a fifth and a quarter of which are exported.

During the seven crowded days of "S.B.A.C. week" this year, well over a quarter of a million people were able to inspect at close quarters the products of 360 companies associated either directly or indirectly with our aircraft industry. Among these were the Society's invited guests, some 26,000 of whom were present on the four "trade" days and included eminent aeronautical engineers and operators and distinguished members of the Services from nearly every country in the World. On the first of the three days when the Show was open to the public there were reckoned to be about 23,000 visitors to Farnborough; and during the two main public days on Saturday and Sunday, the estimated attendances were 105,000 and 110,000 respectively.

Figures such as these give, at least, a statistically superficial idea of the size of an aeronautical display which has no equal. They speak, too, with some eloquence, of the importance of the place that this magnificent annual effort on the part of the British aircraft industry and its Society has come to occupy not only in the world of international aviation itself but as an annual public event of national importance.

However, be that as it may, one has to remember that the things seen at Farnborough this year are in many instances the results of decisions taken five or more years ago. Likewise, the decisions taken now are already determining the extent of the Farnborough scene for the mid-sixties. In this context, there is no need to stress the effects of the policies set out in the Defence White Paper of 1957 and the subsequent severe economies in defence expenditure. Nor is there any need to enlarge on the fact that these have already had a profound influence on the pattern of progress—and a number of promising projects which might well have been seen at some future S.B.A.C. Display would appear destined to remain in brochure form locked up in their designers' desks.

It is all the more important, then, not to underrate the sizeable part that the industry currently plays in the overall economic scene. On the eve of the Show, the president of the S.B.A.C. gave some revealing figures and forecast that the aircraft industry will record a 1958 export income of more than £150 million—an achievement representing no less than 11% of the total engineering goods exported from the U.K. At the end of Farnborough week he announced that an analysis made by the Society had indicated that there were enough new types of aircraft in the offing to ensure there would be a full show at Farnborough for the next three years and that 1960 was likely to be a "vintage" year.

It is, indeed, good to hear that, for the time being at any rate, there is no intention of changing the S.B.A.C. Display into a biennial event. But it remains for much more official encouragement in a practical form to be forthcoming, if our aviation shop window is to remain full of good things.

MATTERS OF MOMENT

A Black Knight Launching

FARNBOROUGH WEEK ended on a note of uplift when it was announced on the afternoon of September 7 that a Black Knight atmospheric re-entry research missile had been successfully launched at Woomera at the first attempt.

First announcement came from Canberra, where the Australian Minister of Supply, Mr. Athol Townley, gave the news of the Black Knight firing. Mr. Townley, who had seen the launching, said that the missile behaved according to plan. It rose from the launching pad and climbed vertically for several thousand feet before being directed into the climb-path towards the selected target area. Several new test techniques were used for safety and tracking. A team set out soon after the firing to recover instruments from the debris in the target area. Telemetry tests and range installation results are being evaluated.

Later in the afternoon Dr. G. W. H. Gardner, Director of the Royal Aircraft Establishment, reported that the launching had been "extraordinarily successful" and that the firing had been "absolutely up to expectations." He did not disclose the exact height attained by the Black Knight but said that it had demonstrated its ability to "put hardware up to satellite height," which he defined as between 150 and 1,000 miles. (It is likely that, in fact, the height reached was about 300 miles or so; using a Skylark as a second stage, the Black Knight could be used to launch a British Earth satellite.) Dr. Gardner said that it was now being considered, with the Royal Society, what further steps should be taken towards a satellite programme.

The Black Knight is a research missile by Saunders-Roe. It is about 35 ft. long and 3 ft. in diameter, powered by an Armstrong Siddeley rocket engine, doubtless of the liquid-oxygen type. Launching was at night, at Woomera, so that tracking flares could be used.

It was revealed that if the launching had been made earlier in the week, a full-size model of the Black Knight would have been shown at the S.B.A.C. show. Instead, small models were quickly displayed on the Saunders-Roe and Ministry of Supply stands: after all but a very small proportion of the visitors to the static exhibition had been to the marquee for the last time. How much better it would have been if the models had been displayed right from the beginning. Even if the first firing had not been successful, letting the World's technicians, and the public, see what Black Knight looked like would have done our missile prestige no harm.

Order For a Rotodyne

AMONG the announcements made during Farnborough week of orders from overseas of British aeronautical equipment, none will have given greater cause for satisfaction than that of the first for a Fairey Rotodyne. The Okanagan Helicopter Group of Vancouver have ordered a Rotodyne for delivery during the next two or three years. The Group's president and managing director, Mr. Glenn W. McPherson, was among the visitors at the S.B.A.C. Display and said that the craft would be used on passenger services between city centres in Canada. With his vice-chairman, Mr. Jack West, and vice-president of development, Mr. J. C. Charleson, Mr. McPherson went to White Waltham on September 4 to see a demonstration of the Rotodyne which had come from Farnborough for an hour or two specially for the purpose.

No figure has been given as to the value of this Okanagan order but it has been said that a Rotodyne would cost around £375,000. With spares the sum involved might well represent considerably more than that.

Fairey's chairman and managing director, Mr. G. W. Hall, F.R.Ae.S., expressed his delight that a pioneering helicopter operator from the Commonwealth should be the first to order "this revolutionary new aircraft." For his part Mr. McPherson said that his Group had thought that if they were going to get in on the ground floor with the Rotodyne, they should order it now.

Okanagan have certainly done some rotary-wing pioneering. They now have a fleet of 54 helicopters and claim to be the largest commercial helicopter operators in the World. In the past 10 years they have completed 100,000 hours and carried 75,000 passengers as well as thousands of tons of freight.

QUICK BUSINESS.—As recorded on this page, one of the most satisfactory revelations during Farnborough week was the news that the Fairey Rotodyne VTOL airliner has been ordered by the Okanagan Helicopter Group of Vancouver.

Photograph copyright "The Aeroplane"

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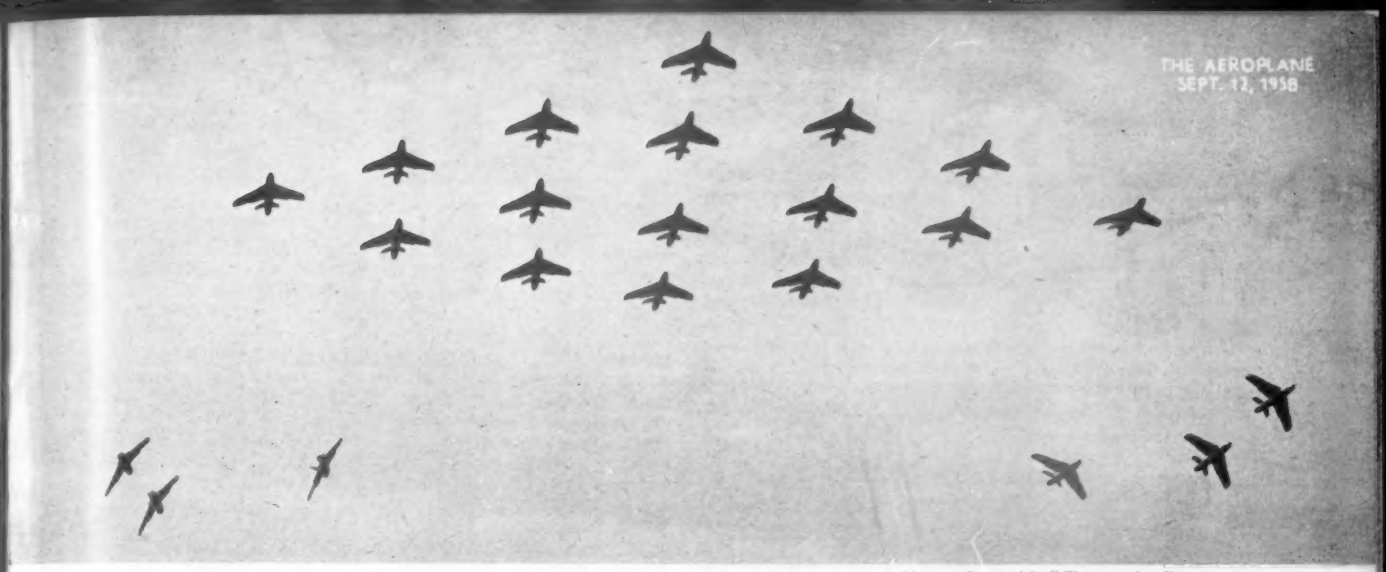

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SHEDDING SIX.—Having completed the second 22-aircraft loop of their display at Farnborough last week, the No. 111 Squadron aerobatic team is seen shedding six Hunters. Following this the remaining 16 complete a barrel roll to port, after which seven more leave the formation.

And Where Are We Going?

Air Commodore F. Rodwell Banks writes :—

WHILE the 9th International Astronautical Congress held in Amsterdam last week was characterized by the usual kindness and hospitality of the Dutch, it was not a happy example of organization. But, at the same time, and with the other previous meetings in this new science, it pointed the way and exposed the enormous amount of activity in the practice as well as the theory of astronautics both in the U.S.A. and in Russia, and how seriously this new science is being taken by nearly every major country except our own.

Lip-service has been paid to astronautics by certain of our Ministers, and scientific personnel from Government Departments have been allowed to attend these conferences, but there can be discerned no signs of an attempt to get into astronautics by a properly constituted and comprehensive research programme—and there are no indications at all of Cabinet interest or encouragement.

With the rundown of the aircraft industry and reduction of its future effectiveness, due to the lack of official support and paucity of military requirements, there may soon be little scientific or technical capacity left to support active entry into astronautics, if there were an official change of heart.

The apparent disinterest at high-level in the Government and the resistance of the Treasury to all things of the Air and Space, faces this country with the prospect of merely becoming a spectator at the start of a Twentieth Century voyage of grand discovery—but, at least, we will all be healthy, if rather dull, at the cost of over £700m. of Health Service Expenditure!

Maybe this doesn't matter at all, but what scientific status will we have in the future if we do not participate in astronautics?

In fact, the U.K. should now be leading the Western European nations in the active study of projects within reach of their respective or combined budgets.

Engines for a Bomber

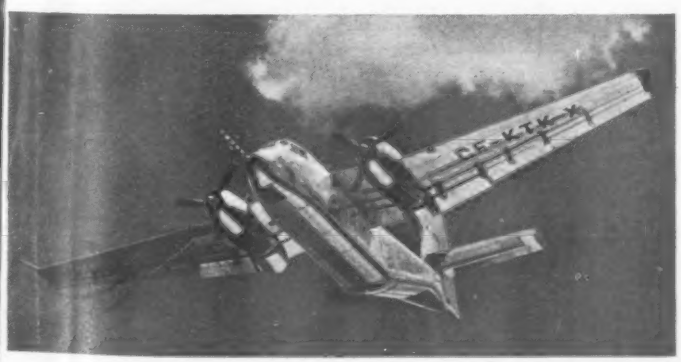
EXHIBITION at Farnborough of a Bristol Olympus B.Ol.7 Mk. 201 turbojet with a Bristol-Solar afterburner raises an interesting issue about its application. There is no indication of any intention to produce a version of the Avro Vulcan—the sole production aeroplane to use the Olympus—with afterburning (which, in any case, would involve major modifications) and there is no officially announced specification for a supersonic aeroplane which could use such engines.

It is, however, fairly common knowledge that a replacement for the English Electric Canberra is in the offing and this requirement must surely be for a supersonic aeroplane—which rules out the Blackburn NA.39 in its present form. With afterburner in operation, the B.Ol.7 gives 24,000 lb. of thrust and a twin-engined aeroplane using this engine would have a very respectable performance—even allowing for the high structure weight necessary for supersonic low-level flight.

Other engines which might be suitable for the Canberra-replacement are the Rolls-Royce R.B.142 military by-pass engine (related to the R.B.41 civil engine for the D.H.121 jet transport) and the D.H. Gyron Junior in its supersonic version.

If it is assumed that the 48,000-lb. thrust of two Olympus engines with afterburning is the maximum needed for the new aeroplane, it is interesting to speculate on how this figure may be reconciled with the other and smaller engines.

Two R.B.142s with afterburning would produce about 40,000



CANADA'S NEW UTILITY.—These are the first pictures showing the prototype de Havilland DHC-4 Caribou, CF-KTK-X, airborne. It made its maiden flight at Downsview, near Toronto, on July 30. Some constructional pictures of this Pratt & Whitney-powered utility transport were published in our issue of August 15.

lb. for a lower specific weight and fuel consumption than an Olympus-powered aeroplane, and the difference of total thrust would thereby tend to be offset. A redesigned supersonic version of the NA.39 using two D.G.J.10 engines with afterburning and two D.H. Spectres for high-speed attack would have a maximum thrust of about 44,000 lb. However, the use of rockets for a low-level bomber can hardly be justified, and this possibility is the least likely of the three.

The choice between the Olympus and R.B.142 would be decided by the date set for the new aeroplane to be ready. If required quickly the Olympus would be the answer because it is available now. If the requirement is set later on, the R.B.142 might be the choice.—D.G.

Aeronautics in Madrid

MORE than 600 delegates from 24 countries gathered in Madrid on September 9, for the opening of the first International Congress of the Aeronautical Sciences. Britain was represented by 57 delegates. Ten of the 46 lectures will be given by British representatives—the only country with more lectures is the United States, responsible for 14 papers. There are no Russian lecturers, but the U.S.S.R. is represented by eight members of the Academy of Sciences.

The first day of the Conference was devoted to two commemorative papers, the Daniel and Florence Guggenheim Memorial Lecture, given by Dr. Theodore von Kármán, and the Juan de la Cierva Memorial Lecture, by Ing. Pedro Blanco.

After the opening day the work of the Conference was divided into general sessions, with special sessions dealing with hypersonic flow, aero-elasticity, heat transfer and the heat barrier, jet-engine noise, navigation and guidance, boundary-layer control, VTOL and STOL, heat-resistant materials, human engineering, and telecommand and guidance. The Conference ends on September 13.—J.R.C.

The 707 Comes to London

ON Monday of this week the third production Boeing 707-120 (N709PA "Clipper America") arrived at London Airport at 08.02 hr. B.S.T. after a training flight from New York. It was due to stay for about 48 hours during which noise assessment tests were to be made by the M.T.C.A.

The 707 had flown over via Gander, Newfoundland, and Shannon Airport and was due to return by way of Keflavik, Iceland. Apart from the acoustic trials at and around London Airport, the main object of the flight was that of providing initial training not only for the flight crews but for the engineering and refuelling crews at the various alternates on the North Atlantic route. Among the 33 persons on board, including 10 crew members, were Mr. Harold E. Gray, executive vice-president of Pan American's Atlantic Division, and Mr. A. M. ("Tex") Johnston, chief of flight testing for Boeing's Seattle Division.

This particular 707 has put in about 130 hours flying with Pan American, and was being flown at the present agreed permissible maximum gross weight of 190,000 lb. with temporary certification. A full certificate for the -120 is expected shortly and P.A.A. hope to take delivery of the first fully certificated aircraft on or about September 19. The date of the first North Atlantic service will depend on training and proving progress, but "early in November" is generally agreed to be likely for the introductory service.

New features of this 707, which came as a surprise to those who went out to L.A.P. to look over the aircraft on its arrival, were the leading-edge flaps, which are hydraulically interconnected with the main flaps and open when the latter are lowered to 9°. Photographs of the nose flaps are on p. 414 and it will be seen that they are positioned under the leading edge inboard of the two outer engine nacelles. In addition to the previously seen vortex generators in the area forward of the high-speed ailerons, similar generators are now arranged in a single upright line on each side of the fin. Unexpectedly, too, this 707 was fitted with Boeing thrust reversers on all engines.

The flight deck layout has positions for five crew members, including a radio operator, flight engineer and the occupant of a very permanent-looking "jump" seat aft of the captain's position.

Pan American propose to treat the North Atlantic services as one-stop operations, though the eastward flights will, more often than not, be made non-stop. Refuelling halts on the westward journey will be made at Keflavik, Goose, or Gander according to the meteorological situation. In zero wind condition the 707-120 will be able to take off at about 238,000 lb. from Idlewild's longest runway which, however, is now being extended from its present 9,420 ft. to 11,200 ft. The runway extension will be ready on January 1, so the zero-wind weight limitation is only likely to apply for two months.

Background information about the 707, and a specially prepared series of drawings, are on pp. 416-417.

Photographs copyright "The Aeroplane"

On the left is a view of the flight deck of the Boeing 707-120 which arrived at L.A.P. on its first visit to Europe last Monday. Below the 707 is seen coming in to land on runway 28L. Thrust reversers were used effectively during the landing run.

Astronautics at Amsterdam—II

This is the concluding instalment of DR. A. E. SLATER'S *account of the International Astronautical Congress. His first report appeared last week.*

AFTER a whole-day excursion to Rotterdam, the International Astronautical Congress settled down to a final one and a half days of lectures before relaxing again for the usual farewell party. Two of the three British papers came into this period.

Mr. R. H. Merson, of R.A.E., Farnborough, described how that institution analysed the orbits of the Russian Sputniks, his particular job being in the computer section, where predictions were made. It appears, rather surprisingly, that single visual observations by amateur and professional astronomers were more useful than fixing a satellite's position by triangulation, using simultaneous theodolite observations or photographs taken from various parts of the British Isles; in fact, only one really good triangulation was secured.

The amount of the Earth's equatorial bulge, deduced from rotation of the Sputnik's orbit, differs from the previously accepted value only by one part in about 300; but, Mr. Merson said, the rate of decrease of the orbit's inclination to the equator, believed to be caused by the rotation of the Earth's atmosphere, was 30 times what would be expected.

Two people on this day, Friday, wanted to send probes to the Sun and the Moon respectively. Mr. R. P. Haviland, of the General Electric Co. at Philadelphia, calculated that a five-step vehicle made up of present-day rockets, two liquid-fuelled and three solid-fuelled, and the lot weighing 260,000 lb., could take a 50-lb. probe as near the Sun as the orbit of Mercury. This is well inside the Sun's atmosphere, which is now believed to extend beyond the Earth.

An interesting feature of Mr. Haviland's paper was a list of items of equipment showing how high a temperature each could stand. Semi-conductors, for instance, could get no nearer the Sun than the orbit of Venus, unless one end of the vehicle could be kept cool. This, he proposed, could be done by using a cone-shaped container with its base kept automatically facing the Sun, so that its sides would be continually in shadow.

Televising the Moon

The Moon probe, proposed by Alessandro Boni, of Italy, in a paper entitled "Moon video missiles and their information efficiency," is a very different proposition; it will relay pictures by television right up to the moment it hits the Moon, and the paper was mainly a discussion of the maximum fineness of detail which television techniques could achieve. He claimed that details 1-cm. wide could be televised from 2 km. away, and the final picture before impact would be from only 2 m. away, showing detail to a hair's breadth. After that, it would be up to the geologists to interpret the pictures.

Results from the Vanguard IGY satellite were described by Mr. J. W. Siry. He pointed out that when perigee (the point on the orbit nearest the Earth's centre) happened to be over the equator, as it was with this satellite, air resistance is at its greatest because, owing to the equatorial bulge, the Earth's surface comes up to meet the satellite and so does the overlying atmosphere.

At great heights in the upper ionosphere, on the other hand, the atmosphere is denser over the poles than over the equator, according to Prof. V. I. Krassovski, of Russia; or, to put it another way, it extends farther out into space, as shown by results obtained from Sputnik 3. This satellite, by the way, registered impacts of 15 micrometeorites per second which, an American pointed out, was more than 1,000 times the frequency found by his own country's satellites.

Another Russian contribution was from Mr. K. F. Ogorodnikov, on "Optical observations of artificial Earth satellites." After describing in detail how they were organized, and how other countries co-operated, he said that present satellites were too faint for achieving the accuracy needed for geodetic research, such as finding the distances between continents, or the exact shape of the Earth, with accuracies of the order of 10 m. At present the uncertainties in these quantities are 10 times as great. Consequently his country's Astronomical Council had considered installing light signals on future Sputniks, which would flash intermittently as they passed over at night.

Terence Nonweiler, formerly of Cranfield and now senior lecturer in aeronautical engineering at Queen's University, Belfast, made another attack on his favourite problem of getting back home safely through the Earth's atmosphere. This time he had studied the effects of using parachutes or similar braking devices, and his conclusion was that you cannot avoid having to put up with a maximum deceleration of about 8*g* at one stage of your descent, whatever the nature of your drag device or however large its area. He also recommended that the descending satellite should have low density to avoid overheating; a sphere with a specific gravity of unity would heat up to about 1,500° C. during the descent.

Explorers Explained

An enormous crowd gathered to hear Prof. Wernher von Braun, whose lecture had to be postponed from the first day to the last because he injured his spine soon after arrival. He gave a detailed history of the Explorer satellites, which were launched by a liquid-fuelled Redstone rocket and a cluster of solid rockets arranged in three stages. We were told why Explorer 5 failed to get into orbit: after the booster had separated, there was still enough residual gas in it to push it forwards again, and in the resulting collision the instrument compartment was upset.

Von Braun's concluding words were: "This little planet, which people once were wont to call 'the world' but which our satellites now circle in 90 minutes, has become too small for war and strife."

It was the first and third Explorers which revealed the existence of a belt of intense radiation above 1,000 km. (621 miles), according to Mr. A. H. Hibbs, who followed Dr. von Braun, and this only happened because their elliptical orbits were more elongated than had been intended, otherwise they would never have gone up so high. In fact, No. 3 reached 2,800 km. (1,740 miles) when first launched, and revealed no falling-off in radiation at that height. Another fact revealed by Mr. Hibbs was that No. 3's telemetering apparatus was out of order for several days after the satellite had spent 4 hr. in a well-known meteor shower which follows the same path as Halley's Comet, and which was overtaking the Earth at the time. This seems to show that space navigators would do well to avoid such showers.

Explorers 4 and 5 were deliberately designed to explore the newly discovered radiation belt and its boundaries, by being launched at an inclination of 50° to the equator instead of 35°, and carrying instruments for that purpose only. Explorer 4, Dr. von Braun stated, has been a complete success.

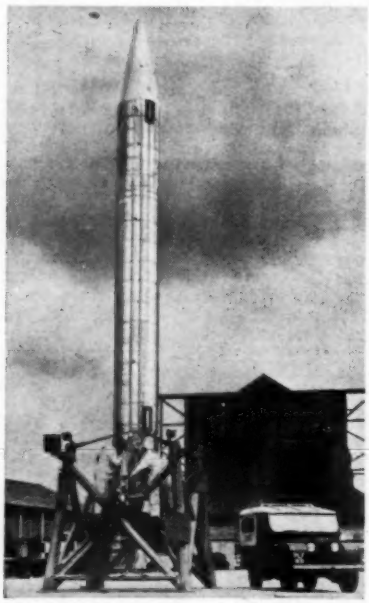
There were few medical papers this time. Perhaps it was because cosmic rays have been rather put in the shade by the newly discovered belt of proton radiation, which may be far more dangerous to life, that the authors of a paper on mutations in barley seeds caused by cosmic radiation at 100,000 ft. failed to turn up to deliver it. But we were told about a "ground simulator of long-range space flight environmental conditions" by Dr. T. C. Helvey of Radiation Inc., Florida.

Dr. Helvey prophesied that "within 10 years the miniaturization and reliability of electronic gear will have been developed to a degree where most of the equipment can become, dynamically and statically, a structural part of the space frame," because of the urgent need to save weight in space vessels, compared with aeroplanes, in which comparatively little extra fuel is needed to carry superfluous structure weight.

He has carried his research into weight economy as far as human anti-radiation suits, which, he says, need not be of the same thickness throughout, because some parts of the body are more susceptible to radiation than others and the shielding should be thicker there than elsewhere: thus the overall weight for a given degree of protection is reduced. The brain, he alleged, "does not need much protection against radiation." Rather oddly, he claimed that better protection was obtained by distributing lead in the form of a close grid than in a continuous layer.

Representatives of Britain, Canada, South Africa and India took the opportunity to meet and decide on a Commonwealth conference on space travel, to be held next year in London just before the I.A.F. Congress, which is also to be held there. Meanwhile the British Interplanetary Society is finding out what each country in the Commonwealth could contribute towards a common space-flight programme.

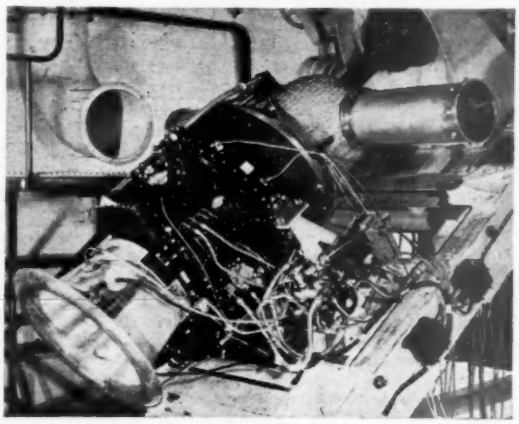
News of Aircraft, Engines and Missiles



BRITISH BALLISTICS.—At the first attempt, a Saunders-Roe Black Knight ballistic research missile was successfully launched on September 7 at Woomera and completed its planned flight.

ELECTRA STATUS.—On August 30, Lockheed had five Electras flying, four in pre-flight status, seven in post-final status, 16 in final assembly and 11 in sub-assembly. Those flying were three of Lockheed's own aircraft, the first for Eastern Airlines, and General Motors engine development aircraft. All in pre-flight and post-final stages are destined for Eastern, the first for American Airlines being in final assembly. The third-built Electra has been modified as an aerodynamic prototype of the P3V-1 for the U.S. Navy and is now flying again.

VTOL KAMAN.—Under development for the U.S. Navy is a new VTOL/STOL research aircraft, the Kaman K-16B, to be powered by General Electric T58 engines. The K-16B will have fixed wings and rotors which serve as propellers in forward flight at speeds up to 300 m.p.h.



FIRST RUN.—The Armstrong Siddeley P.181 1,100-s.h.p. shaft turbine engine first ran early in the week of the S.B.A.C. Show. The angle of its mounting on the test-bed suggests that a coupled P.181 powerplant could be used for the Westland Wessex or a single engine in the Whirlwind.

RAMJET BOMB.—Use of ramjets to power later types of stand-off bomb is suggested by Bristols. This type of engine could also be used for intermediate- and long-range winged bombardment missiles flying in the atmosphere at Mach 3.0. Above Mach 2.5 the ramjet is more efficient and economical than the turbojet.

AIR SPEED RECORD.—The F.A.I. has confirmed the World's air speed record of 2,259.538 k.p.h. (1,404 m.p.h.) set up by Capt. W. W. Irwin, U.S.A.F., on May 16. The flight was made at Edwards, Calif., in a Lockheed F-104 Starfighter (G.E. J79 turbojet).

ELECTRIC HOVER.—Kaman has announced the successful flight of an electrically powered helicopter. A lightweight high-voltage electric motor replacing a piston engine was supplied with current from a 250-kW. gas-turbine driven alternator on the ground. This work is for the U.S. Navy Bureau of Aeronautics and is presumably for unmanned surveillance drone helicopters.

SIKORSKY CENTURY.—The 100th Sikorsky S-56 helicopter (an HR2S-1 version) was rolled from the flight hangar at Stratford, Conn., on August 27, for delivery to the U.S. Marine Corps. The S-56, also supplied to the U.S. Army as the H-37A Mojave, went into production in 1955.

U.S. NAVY'S NEWEST.—The North American A3J Vigilante two-seat naval attack bomber (two G.E. 79/2 turbojets) is here seen on its first flight at Port Columbus on August 31.

MOHAWK CHANGE.—A new artist's impression of the Grumman YAO-1 Mohawk observation aircraft (design number 134) shows it now to have a triple tail unit replacing the single fin and rudder. As recorded in THE AEROPLANE for August 29, the U.S. Army recently ordered 35, in addition to nine ordered last April.

Commercial Aviation Affairs

COMET 4 DEPARTS.—The Comet 4 G-APDA left Hatfield at 10.16 hrs. local time on September 8, bound for Cairo, Bombay, Bangkok and Hong Kong for route proving and demonstration. Captained by John Cunningham and carrying senior B.O.A.C. captains, engineers and cabin staff, the Comet will be present for the opening of Kai Tak's new runway on September 12. Plans are now being made for a flight to the Americas, to complete the 100 hrs. of route proving necessary for a C. of A.

ELECTRA TOUR.—During October, an Electra is scheduled to make an intensive tour through Europe and the Middle East. Tentative itinerary includes stops at Amsterdam, Brussels, Copenhagen, Oslo, Stockholm, Cologne, Zürich, Vienna, Istanbul, Teheran, New Delhi, Bombay, Athens, Rome, Paris, London, Weisbaden, Dublin, Keflavik and Argentina.

HEAVIER VISCOUNT.—Vickers have announced their intention of raising the gross weight of the Viscount 810 series from 69,000 lb. to 72,500 lb. Engineering development and flight tests are well advanced. Effect will be to increase max. payload range from 800 to 1,200 miles or, with 250-gallon slipper tanks, the max. range to 1,650 miles with 10,400 lb. payload.

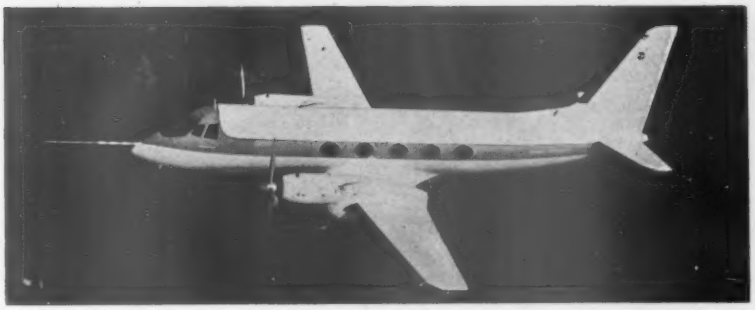
MALAYAN EXPANSION.—A 55-seat DC-4 has been leased to Malayan Airways from Qantas, to operate services from Singapore to Hong Kong and Djarkata. Qantas will train three captains and three first officers, and eight stewardesses are also under training.

B.E.A. VANGUARDS.—Half the 20 Vanguards ordered by B.E.A. will now be delivered as Type 953 to the new Vanguard 2 Specification with Tyne R.Ty.11 engines and increased payload.

YEADON DEREQUISITIONED.—Bradford and Leeds Corporations will pay £6,000 each for the derequisitioning of Yeadon Airport. Purchase of an additional 20 acres of land is being negotiated. Expenditure of £40,700 on runways, aprons, airfield lighting and controls, terminal buildings and the additional land has been approved. A hangar and 10 acres of land will be leased to the Air Ministry for £2,750 a year.

DECCA FOR LULSGATE.—Decca Type 424 Mark 2 airfield control radar has been ordered for installation at the Bristol Airport, Lulsgate.

BRITISH-ENGINED.—The Grumman Gulfstream made its first flight on August 14 at Bethpage, New York. This 10-19 passenger executive aircraft has two 2,105-e.h.p. Rolls-Royce Dart R.Da. 7/2 turboprops and is pressurized for normal operation at 25,000 ft. A maximum cruising speed of 370 m.p.h. is expected.



KUWAIT VISCOUNTS.—A Viscount 745, to Capital Airlines standard, has been purchased by the Kuwait Oil Company. Two Viscounts leased from Middle East Airlines are now being operated by Kuwait Airlines.

IATA TRAFFIC CONFERENCE.—Annual review of fares and freights for scheduled international airline service by the 86 IATA member airlines will begin on September 23 at Cannes. In the chair will be Mr. P. C. F. Lawton, of B.E.A.

LUFTHANSA CHANGE.—In future part of Lufthansa's engineering—particularly on the Conway-powered Boeing 707—will be done at Frankfurt. Other major work will be carried out, as before, at the workshops in Hamburg (Fuhlsbüttel).

THE SOUTHALL ACCIDENT.—A public inquiry is to be held into the accident to a Viking of Independent Air Travel at Southall on September 2. The crew of three, and four occupants of the houses on which the aircraft crashed, were killed.

News About People

COACHMAKERS OFFICERS.—The Worshipful Company of Coachmakers and Coach Harness Makers at a meeting of the Court on September 1, elected the following officers for the ensuing year: Master, Mr. R. J. D. Smith; Senior Warden, The Hon. Denis Berry, T.D.; Renter Warden, Sir Reginald Verdon Smith, and Junior Warden, Col. G. A. Norris, O.B.E., M.I.Mech.E.

EAGLE APPOINTMENT.—Eagle Airways (Bermuda), Ltd., announce the appointment of Mr. Harold Graham as executive president of the company, with effect from August 1, 1958. Mr. Graham, a former Lt.-Col. in the U.S.A.F., has, since 1954, been president of Resort Airlines, Inc., which he joined in 1953 as executive vice-president.

GOODYEAR DIRECTOR.—In succession to Mr. D. Gow, who has retired, Mr. H. A. Brundage has been appointed financial director and secretary of the Goodyear Tyre and Rubber Co. (Gt. Britain), Ltd. Mr. Brundage comes from the U.S.A. and has been with the Goodyear organization since 1941.

PYRENE ORGANIZATION.—Mr. W. L. Baker, manager of the Metal Finishing Division of the Pyrene Co., Ltd., retired on September 1. He will be succeeded by Mr. H. A. Holden who has had many years' experience in the Division. Mr. H. F. Parshall continues as director in charge of the Division.

BIRFIELD P.R.O.—Mr. G. W. Kelland, A.M.I.Mech.E., A.I.T., has been appointed public relations officer of the Birfield Group as from October 1. His office will be at Stratford House, Stratford Place, London, W.1. (Tel., Grosvenor 7090.) He has been editor of *The Transport Journal* since 1953.

INTEGRAL DIRECTOR.—Mr. L. S. Greenland, chief designer and director of H. M. Hobson, Ltd., has been appointed a director of Integral, Ltd.

B.O.A.C. RETIREMENT.—Mr. P. T. Griffith, A.F.R.Ae.S., A.M.I.Mech.E., purchasing controller of B.O.A.C., is shortly to retire from the Corporation. He has been in civil aviation for nearly 40 years.

C.A.A. APPOINTMENT.—Mr. R. P. Hartley, A.C.I.S., has been appointed assistant general manager of Central African Airways. He became chief accountant to C.A.A. upon its formation in 1946, and has been secretary since 1957.

F.A.I. AWARD.—Col. Rod Douglas has received a Paul Tissandier Diploma in recognition of his distinguished services to aviation. He learnt to fly in the R.F.C. in 1917, founded the Johannesburg Light Plane Club in 1926 and in the following year was a co-founder of the Aero Club of South Africa. During the Second World War he was Director of Air Personnel, S.A.A.F., and later was president of the S.A.A.F. Association.

Military Aviation Affairs

R.A.F. GAYDON "AT HOME."—Among the R.A.F. stations "At Home" on September 20 (see page 420), Gaydon Warwickshire, promises to have a show second only to Farnborough. Apart from a flying display which includes the station's Victors and Valiants, No. 56 Sqn. acrobatic team and a Canberra aerobatic team from R.A.F. Bassingbourn, a static exhibition will include a number of exhibits from the S.B.A.C. Show.

H-BOMB TEST.—A Vickers Valiant of No. 49 Sqn. (Wittering), dropped what was described as a high-yield nuclear device in the megaton range over the Central Pacific on September 2. The device was exploded successfully at a great height.

TWO-SHOW PARTICIPANT.—Piloted by Sqn. Ldr. D. J. Skeen, a Vulcan of No. 101 Sqn. flew from the S.B.A.C. Show at Farnborough to the Canadian International Air Show at Toronto on September 5. The 3,570-mile trip was made in 6 hr. 58 min., an average speed of about 512 m.p.h. Piloting the aircraft on the return journey, on September 7, was Flt. Lt. W. S. Green. The time was 5 hr. 48 min., an average speed of 615 m.p.h.

No. 600 SQUADRON.—At the R.A.F. Biggin Hill "Battle of Britain" day on September 20, No. 600 City of London Sqn. Association will have a tent at South Camp at which all members will be welcome.

AIR STATIONS HONOURED.—Two Service air stations, R.N.A.S. Culdrose and R.A.F. Felixstowe, are to receive civic freedoms. The R.A.F. station is to be granted the freedom of Felixstowe on September 26 and R.N.A.S. Culdrose is to be similarly honoured by the Borough of Helston on September 12.

PHILIPPINES FLIGHT.—A squadron of U.S.A.F. Super Sabres on the first leg of a 7,000-mile flight to the Philippine Islands flew from their base in California to Hawaii in less than 5 hr. During this 2,200-mile non-stop trip they were refuelled at about 15,000 ft. by Boeing KB-50 tankers.

R.A.A.F. JET TRAINING.—Two new R.A.A.F. units have been formed to convert pilots and navigators to operational aircraft. One unit, based at Williamtown, will operate Avon-Sabres and start its training programme immediately. The other unit, equipped with Canberras, will come into operation at Amberley before the end of this year.

SUPER SABRES IN SPAIN.—North American F-100 Super Sabres are now operating with the First Tactical Fighter Squadron, U.S.A.F., based at Morón de la Frontera, near Seville. They are the first supersonic fighters to join S.A.C. air defences in Spain. Commanding the squadron is Col. "Chuck" Yeager who, in the Bell X-1, became the first man to fly faster than sound.

GERMAN EQUIPMENT.—No decision has yet been made regarding the type of fighter with which the West German Air Force will be equipped. The latest delay is so that the French Dassault Mirage III can be further assessed. The other contender is the Lockheed F-104 Starfighter.

Air Transport

The Argentinian Comets

AEROLINEAS Argentinas will take delivery of the first of their initial three Comet 4s next February and will put these aircraft into service during May. Between that month and April, 1960, the Argentine airline will operate four services a week between Buenos Aires and New York, with stops at Rio de Janeiro and Trinidad, and two weekly services between Buenos Aires and London, via Rio, Dakar, Madrid/Rome and Paris/Frankfurt.

The second series of three Comets will be delivered between April and June, 1960, and the weekly frequencies of the two international trunk services will then be stepped up to seven and four respectively.

Aerolineas will, throughout the period, fly a daily Comet service to Santiago, Chile.

These were the main points made at a very informing Press conference held by Aerolineas Argentinas last week and presided over by Air Cdre. Juan José Guiraldes, the president of the airline.

This order for Comets is a particularly interesting one since it is the first sign of a break-through into the market consisting of those airlines whose future stage-traffic potentialities and airport qualities are suited to the use of a medium-sized turbojet transport with good, " normal " take-off and climb performances and handling characteristics. There must be many airlines requiring aircraft in the Comet 4 or 4B category in comparatively small numbers and it is only a pity that prospective customers will need to wait so comparatively long for a delivery.

The good delivery dates for the first three aircraft for Aerolineas have been made possible because of the production plans designed to find early places in the line for the Comets originally intended for Capital Airlines. The Argentine aircraft will, in fact, be the eighth, tenth and eleventh from the line (including the aircraft used for structure-testing), and will, consequently, follow the sixth to be delivered to B.O.A.C., whose schedule will not be affected. The second batch of Comets for the Argentine will follow the 19 for the Corporation and any further orders will involve delivery dates during the latter half of 1960.

Payment for the Argentine Comets, totalling some £10m., will be on a basis of 5% as a down payment, 20% on delivery and the remainder in the form of a 6½-year loan, by a group of British banks and finance houses including Air Finance, Ltd., backed by a guarantee by the British Government. Interest on the loan is to be paid at the rate of 6½%.

The first three aircraft are to be similar in layout and equipment to those of B.O.A.C. They will be laid out for 23 first-class and 44 tourist-class passengers. The plans for the second three aircraft have not yet been finalized. It may be that experience with the British navigation aid and other equipment in the first batch will encourage the use of similar equipment—or it may be that preference will be shown for standardization in relation to the equipment in other aircraft of the Aerolineas fleet. Charles Butler Associates will look after the décor and furnishing plans.

When the Comet 4 has been introduced, Aerolineas will withdraw the DC-6 fleet from the routes to the U.S.A. and Europe, but will continue to use them—and possibly additional aircraft of the type—on South American and domestic services. Such services will involve a utilization rate for the DC-6s of more than 2,900 hours per annum, while the Comets on the trunk routes will initially be working at the rate of 3,285 hours per annum. The addition of the Comets to the Argentine Airlines' fleet will increase the offered capacity from 474 million (in 1957) to about 800 million passenger-kilometres.

Four crews—each consisting of a captain, a co-pilot, a radio operator, a flight engineer, a navigator, a purser and a stewardess—will be trained initially in England, and the first of these crews is due here within the next month. These crews will be ready for the first Comet operations in May, 1959, and will, in turn, train the remaining crews required as the fleet is built up. In all, including engineers and others, a total of 105 people will eventually be under training in England.

Aircraft and ancillary maintenance will be completed at the operator's base at Ezeiza, the international airport for Buenos Aires, but, until the end of 1960, when trained personnel and equipment will have become available, the overhaul of the Avon engines will be completed by Rolls-Royce in England.

Colonial Coach Competition

IN THE AEROPLANE of August 8 (p. 193) we commented on one of the statements in B.O.A.C.'s annual report. This was to the effect that the Airwork/Hunting-Clan Colonial Coach services, with Viscounts to and from points in Africa, had adversely affected the Corporation's financial results; that B.O.A.C. was still " obliged " to operate tourist-class services with DC-4M Argonauts in competition with faster Viscounts operated at lower fares; and that the coach-class services, designed to cater for a new class of traffic, had caused increasing inroads into the Corporation's traffic.

We pointed out the anomalies of a situation in which B.O.A.C. complained about competition and loss of traffic, while the independent operators were restricted in the frequency of services which were, in consequence, fully booked for some time ahead. Now Hunting-Clan has come up with a sharp reply to the Corporation's complaints.

Briefly, the reply covers nine points, the more important of which are as follows:—

B.O.A.C. could have been using Viscounts on the African routes some four years ago.

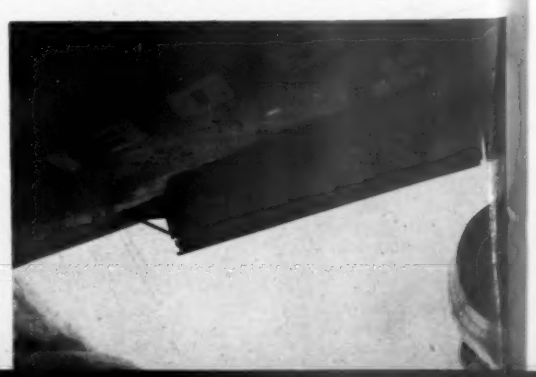
The Viscounts now used by H.C.A. and Airwork were not allowed on the service until B.O.A.C. were operating Britannias on the African routes.

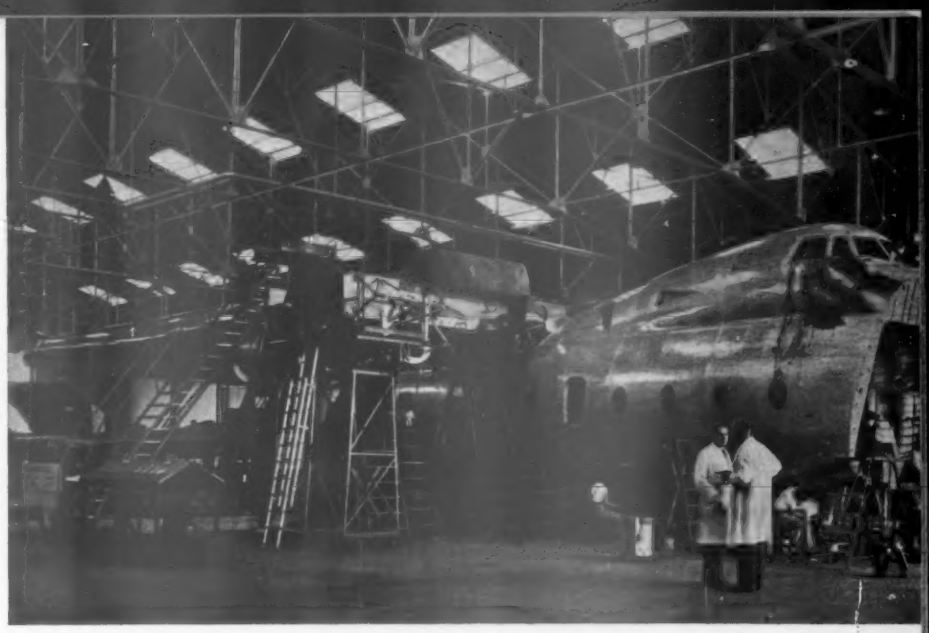
B.O.A.C.'s attitude has been inconsistent since 1951, when the introduction of a Colonial Coach Class-type service was strenuously opposed. The B.O.A.C. argument, that such a service would divert traffic from the normal scheduled service, has been proved wrong in practice, and B.O.A.C. now want to take advantage of the traffic generated by the " third-tier " service.

Colonial Coach Class capacity compared with the overall B.O.A.C. capacity is so minute that it is " ridiculous " to credit it as a factor affecting B.O.A.C.'s overall results.

Finally, Hunting-Clan point out that the A.T.A.C. seem to be satisfied that the Colonial Coach services are performing their approved function and are not significantly undermining B.O.A.C.'s activities.

A small hydraulically-operated leading-edge flap has been fitted to the Boeing 707, inboard of the outer pods, to operate when the main wing flaps are extended by 9° or more. The modification is designed primarily to improve control at low speeds at take-off when the wing is at a high angle of attack.





ARGOSY PROGRESS.—This picture, taken in mid-August, shows the first Armstrong Whitworth Argosy in final assembly at the company's Bitteswell factory. This prototype is expected to fly early in November, and will be quickly followed by others of the pre-production batch next year.

North Atlantic Traffic Trends

TRAFFIC statistics for the I.A.T.A. carriers flying on the North Atlantic route are published below, for the first and second quarters of 1958. A breakdown of these figures into the results for individual carriers, as published in THE AEROPLANE for February 7 and May 9, 1958, no longer proves possible.

Whilst the tabulated figures reveal the continuing upward trend in traffic, when compared with results for the same quarter in 1957, they also show a marked drop in load factors. This has been brought about by the introduction of bigger-capacity aircraft as well as greater frequencies; the figure of 60.7% recorded in the second quarter is not unreasonable but the 53% in the first quarter is rather low for comfort. The seasonal nature of the traffic is well illustrated by the high load factor —82.8%—achieved eastbound during June, whilst the westbound factor was well under 50%.

It is still too early to judge the long-term effects of introducing economy-class travel, but the results for the first quarter in which they operated (April-June, 1958) seem to be quite satisfactory. Nearly 60% of all Atlantic traffic went by the new class, and only 21% of the total was first class, the other 19% being tourist. In the previous quarter, just under 30% of the total traffic was first-class.

NORTH ATLANTIC TRAFFIC

	First qtr. 1958	% change 1957	Second qtr. 1958	% change 1958
Scheduled flights ..	5,580	+ 20.0%	8,622	+ 34.1%
Seats offered	300,229	+ 23.0%	553,108	+ 49.5%
Revenue pass.	159,151	+ 4.7%	335,615	+ 24.6%
Pass. load factor, % ..	53.0	— 8.5%	60.7	— 12.1%
Freight, kg.	5,090,021	+ 3.2%	5,159,608	+ 12.3%
Mail, kg.	2,449,005	+ 15.6%	2,402,138	+ 9.5%

Confusion in Australia

ON his return from Europe and the U.S.A. to Australia, Mr. R. M. Ansett announced that his airline, Ansett/A.N.A., was due to take delivery of four Lockheed Electras, six Viscount 832s and six Fokker F-27s.

According to a correspondent, Senator Paltridge, Minister for Civil Aviation, wasted no time in issuing a statement to the effect that his government had approved for the airline only two Electras, four Viscounts and four F-27s—a re-equipment approval which was already common knowledge. The senator pointed out that the government would critically examine the overall position of the Australian airline industry before taking any decision concerning the approval of additional aircraft.

Loss of the Dart Herald

LAST week, Handley Page, Ltd., issued a statement in connection with the loss of the prototype Dart Herald in the course of a flight from its home base at Woodley to Farnborough, on the eve of the S.B.A.C. Display. The accident occurred immediately after the Dart Herald—flown by the company's chief test pilot, Sqn. Ldr. H. G. Hazelden—had posed for air-to-air pictures to be taken by THE AEROPLANE photographer and others.

The Handley Page statement says that there was a "serious failure" of the starboard Dart at 6,000 ft., as a result of which parts of the engine were thrown through the engine casing and damaged the fuel lines. An uncontrollable and catastrophic fire ensued. Before the pilot was able to make a forced landing, the fire first burned through the engine bearers, causing the engine to fall out, and then burnt off part of the starboard tailplane. In these circumstances, Sqn. Ldr. Hazelden is to be congratulated upon the skill with which he completed a landing in a small field, without injury to any of the nine occupants. The aircraft quickly burnt out.

The loss of the Dart Herald was a particularly serious blow for Handley Page, who had been looking forward to demonstrating the aircraft in its new turboprop version for the first time at Farnborough. The company states that this prototype had flown more than 200 hours and had almost completed certification tests. The loss, the statement continues, "will in no way influence the aircraft's production programme, which is well advanced. A second Dart Herald will be flying within the next few weeks."

Until Rolls-Royce—who concurred in the Handley Page statement—have had an opportunity to examine the engine, it is impossible to establish the primary cause of the accident, and it is certainly premature to blame the turbine itself, as is being done in some quarters. The report suggests that the whole turbine disc disintegrated—since the loss of one or several blades alone could hardly have caused so much damage. This in turn suggests some other factor leading to the failure of the disc—such as, for instance, a reduction-gear failure followed by overspeeding of the engine.

The accident is reminiscent in some ways of that to the second prototype Britannia in February, 1954, when a reducing-gear failure led to overspeeding and a turbine disc break-up and uncontrolled fire. The aircraft made a forced landing in the Severn Estuary. It is also relevant to record here an incident which occurred in mid-July to Continental Airlines' first Viscount 812—powered, like the Dart Herald, by Dart R.Da.7 engines. It was reported that one engine of this aircraft "threw several blades," with the result that holes were torn in the starboard side of the fuselage and the top of a nacelle, and an upper engine mount was cut in two. In this case, the failure was in no way catastrophic, but once again the reports of damage suggest something more serious than the loss of turbine blades, which could be expected to pass out of the engine tailpipe.

The Boeing 707

ATTENTION was focused upon the Boeing 707 this week by the expected arrival of one of Pan American's fleet at London Airport on September 8 (after this portion of the issue went to press). It was to be the first occasion on which an American civil jet transport had crossed the Atlantic.

The aeroplane which P.A.A. is now flying is the 707-120, first of the Boeing family of jets, but not the smallest. Only six of these will be delivered to Pan American (all by the end of this year) followed in due course by 17 of the very much enlarged 707-320 type. With the 707-120s, the airline expects to become the first U.S. operator with turbojet equipment on the North Atlantic route.

Development of the Boeing 707 began as a Boeing private venture more than six years ago, when the company embarked upon a $16 million gamble to obtain military backing for a tanker-transport which would have commercial applications. It is now well known that the gamble came off to the extent that 336 KC-135s have already been ordered by the U.S.A.F., and nearly 200 civil versions are on order for 15 of the World's major airlines—B.O.A.C. among them.

The KC-135 is now, in fact, a rather distant relation of the civil aeroplane, although many of the basic components are still built on common jigs. In size, the KC-135 and 707-120 are similar, although the former operates at a higher gross weight even than the big 707-320. Undoubtedly, Boeing—and for that matter prospective operators of the 707—are learning a great deal from the U.S.A.F. operations with the KC-135; and in one case the price of that experience has been tragically high.

A few dates are of interest to show how Boeing have progressed with development of the 707. The original prototype (which bore the designation 367-80) flew on July 15, 1954, and has now amassed more than 1,000 hours in the air. It has been used for a variety of trials, including the early flight development of the refuelling boom for the KC-135 and of the sound suppressors for the 707-120. It was originally powered by four Pratt and Whitney JT-3A turbojets rated at 11,000 lb. s.t. each with water injection, but has since flown with other engines and recently had a combination of two early JT-3Ps, one JT-3C-6 as used in the production aeroplane and one JT-4 of the type to be used in the 707-320.

Pan American placed an order for 707s on October 13, 1955—being the first company to do so—and Boeing set about developing the type for production. Many changes were made from the "dash-80" design, and the first production 707-120 made its first flight on December 20, several days ahead of schedule. This aeroplane, and the next two, were applied to the C.A.A. certification programme—the ground work for which had been laid by the "dash-80."

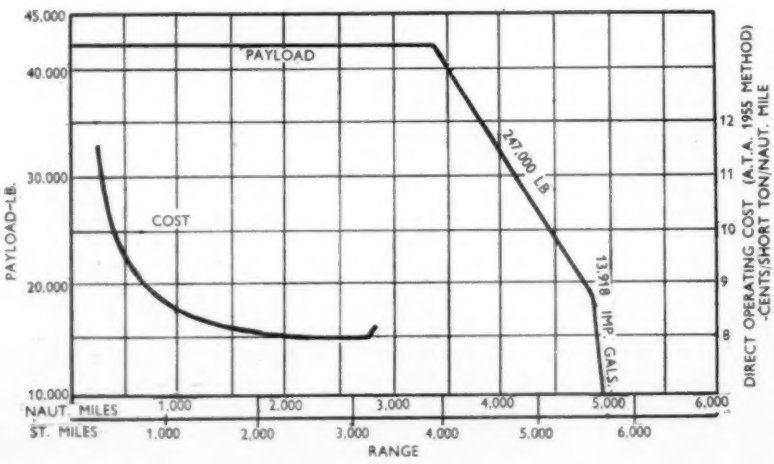
In less than eight months, these first three aircraft, including one sporting the full P.A.A. livery shown on the next page,

had completed all necessary C.A.A. flying and a provisional type certificate was granted on August 15. This permitted the use of the type on training, route-proving and other non-revenue airline flights, and a special provision was made on this certificate for P.A.A. to operate revenue cargo flights between New York and San Juan, Puerto Rico. On the same day, P.A.A. took formal delivery of their first 707 at Seattle and a week later, on August 22, the first revenue flight was made by 707, between Miami and San Juan, carrying freight.

The Boeing 707-120 as delivered to P.A.A. is powered by four Pratt and Whitney JT-3C-6 turbojets rated for commercial operation at 13,000 lb.s.t. with water injection (or 11,200 lb. without). This engine is the commercial equivalent of the military J-57, which has nearly two million hours of operation behind it. Sound suppressors and thrust reversers for this engine have been developed by Boeing and are fitted as standard. An announcement by Boeing last week claimed a reduction of 12 decibels in sound level in relation to the unsuppressed engine—compared with the 6-decibel reduction guaranteed by Boeing. More than $10 million has been spent on development of the suppressors to date.

Maximum take-off weight of the 707-120 is 247,000 lb., and the balanced field length required at this weight, to meet the requirements of C.A.R. 4b and S.R.422, is 9,600 ft. at sea level in I.S.A., and 10,392 ft. at sea level in I.S.A. +15° C. (which is 86° F.). A graph on this page, prepared specially for THE AEROPLANE by the Boeing Airplane Co., shows the payload-range performance (no reserves) and the estimated operating costs. Basic dimensions appear opposite.

Details of the internal layout to be used by Pan American have not been given, but the company is known to favour simple, straight-through layouts, possibly with some aircraft devoted wholly to economy- and tourist-class seating. Boeing information is that the 707-120 can seat 121 in first-class seating, 143 tourists, or 177 with a coach-class arrangement.



These curves, prepared by Boeing in June of this year, show the payload range performance and estimated direct operating costs for the domestic 707-120 with a crew of three and sound suppressors fitted. The range curve assumes max. fuel capacity; allowance for take-off, climb, cruise and descent with no reserve; and net caloric fuel content, 18,400 B.T.U.s per pound. The costs are based on 1955 Revised A.T.A. Method, and assume 10-year depreciation with 10% residual; 1,000-hr. engine overhaul life; engine maintenance costs at $20/eng.-hour; 5% insurance rate; 10% airframe and 75% engine spares rate; and $75,000 allowance for customer-furnished equipment. Block time includes 15-minute block factor; fuel burned includes 1,000 lb. taxi allowance.

THE BOEING 707-120

Four Pratt & Whitney JT-3C-6

Span 130 ft. 10 in.
Length 144 ft. 6 in.
Wing area 2,433 sq. ft.
Gross weight 247,000 lb.
Cruising speed 457-514 knots.

Drawings by Roy Cross, copyright "The Aeroplane."

London's International Terminal

Photographs copyright "The Aeroplane"

These striking new pictures of London Airport show, in particular, the need for additional apron space in the Central Area. The view below is one looking towards the east, with the maintenance area at the top of the picture. On the right is a part of the maintenance area, with B.E.A.'s present engineering base and the additional base under construction. At the top of the page is a detail of the Central Area, with the control block, the present terminal building and the Queen's building.

Some thirty people attended this year's annual gathering of the Trainees of Imperial Airways. In addition to Mr. George Woods Humphery, the guests were Major J. R. McCrindle, Mr. Tony Milward and Mr. Thurstan James.

Triple Napier Jubilee

A RECEPTION was held in the Savoy Hotel, London, on September 3 to mark the 150th anniversary of D. Napier and Son, Ltd. Guests were received by Sir George and Lady Nelson and among the earliest arrivals was Lord Brabazon, looking in very fine fettle indeed. It is hard to realize that next year we shall be celebrating the 50th anniversary of his historic flight at Eastchurch.

Among other early arrivals were Sir George and Lady Dowty. Sir George has recently been elected a vice-president of the S.B.A.C. which means he is in succession to the presidency. A measure of his services to the industry may be gauged by the fact that he will be the first member of a non-major aircraft firm to be so elected.

A place of honour was taken by a portrait of the founder of the company, not as the young man of 23 from Inverary who founded the company in 1808, but as David Napier, the venerable patriarch who lived to see the widespread establishment of his business and of his fame as an engineer. What pride he might have taken in the remarkable performance, witnessed by so many of the guests at Farnborough earlier, when a Canberra had demonstrated the missile-like climb performance made possible by the installation of the Napier Double Scorpion rocket motor.

(A history of the Napier Company appeared in THE AEROPLANE for June 6 last.)

Helicoptering at Dinner

ALTHOUGH the rotary-wing craft is inherently a short-range vehicle, its enthusiastic protagonists clearly have an operational endurance greater than that of their products. This was made manifest at the 12th annual dinner of the Helicopter Association of Great Britain at the Dorchester on September 4, when two of the distinguished speakers achieved what can only be described as marathon performances. Indeed, one guest was heard to suggest that to the list of records set up by helicopters, should be added the verbal wordage produced on this the premier occasion of Britain's helicopter year.

During the course of the evening the Alan Marsh Memorial Medal was presented to Lieut. Cdr. G. G. R. Miller, R.N., for a particularly courageous piece of helicopter flying at night in dense fog to save the life of a boy in urgent need of hospital attention. Likewise the Alan Marsh Award—a short course of helicopter flying instruction—was presented to Mr. K. F. Topp, a student of the College of Aeronautics, for his exceptional work and studies in the rotary-wing field.

As the principal guest, SIR CYRIL MUSGRAVE, K.C.B., Permanent Secretary to the Ministry of Supply, proposed the toast to the Association and spoke of the remarkable achievements of the helicopter industry in getting five new helicopters airborne during the past 12 months.

MR. ERIC MENSFORTH, C.B.E., M.A., F.R.Ae.S., M.I.Mech.E., M.I.Prod.E., president of the Association commented that there were whispers in the air of marriage with the Royal Aeronautical Society. He made it clear, however, that should such a marriage take place, the Association's social functions would continue; and this met with the applause it deserves, for the H.A.G.B. annual dinner is reckoned by most to be one of the more pleasant and friendly aeronautical social occasions.

Replying on behalf of the guests, MR. IGOR SIKORSKY—the grand old man of helicopters—succeeded in delivering a complete lecture on the history, present achievements and future prospects of the helicopter.

It seemed a pity, though, that among all that was said of the brightness of Britain's helicopter future, the point was not hammered a little more firmly home by some mention of the order by Okanagan Helicopters of a Fairey Rotodyne.—F.T.M.

Above, Lt. Col. G. R. D. Shaw and Mr. Charles Newton with Gp. Capt. Douglas Bader who had flown up to open the new airport restaurant at Sywell last week. It will be welcomed by the increasing number of travellers using the airport now that the Marathons of Derby Airways (right) link the Midlands with Jersey and the Channel Islands.

The Fighting Services

Senior Appointments

AIR VICE-MARSHAL H. D. SPRECKLEY, C.B., O.B.E., is to become Controller of Engineering with effect from February 1, 1959, with the acting rank of Air Marshal. At present A.O.C., No. 24 (Training) Group, Technical Training Command, A.V.M. Spreckley was previously Director-General of Technical Services at the Air Ministry and, before that, Commandant of the R.A.F. Technical College, Henlow.

The next A.O.C. of No. 24 Group is to be Air Vice-Marshal J. Marson, C.B., C.B.E., who will take up the appointment on January 1, 1959. At present serving as Director-General of Technical Services at the Air Ministry, A.V.M. Marson was President of the Ordnance Board from 1956 to 1957. Before that he was A.O.C., No. 42 Group, Maintenance Command, from 1951 to 1954.

Air Commodore V. D. Morshead, Senior Technical Staff Officer, 2nd T.A.F., since June, 1955, is to become Commandant of No. 4 School of Technical Training, R.A.F. St. Athan this month. Previously S.T.S.O., Transport Command, Air Cdre. Morshead has been succeeded at 2nd T.A.F. by Gp. Capt. H. M. Russell, O.B.E., with the acting rank of Air Commodore.

Group Captain J. B. Voyce, D.F.C., has been appointed Air Officer in charge of Administration at Headquarters, 2nd T.A.F., with the acting rank of Air Commodore. In 1953-54 he was with the NATO Air Training Advisory Group in Paris, and for the past three years has been Senior Administrative Officer at Headquarters, No. 11 Group, Fighter Command.

Importance of Fighter Control Units

VISITING No. 3604 (County of Middlesex) Fighter Control Unit, R.Aux.A.F., during the unit's recent summer camp at R.A.F. Sandwich, Mr. C. I. Orr-Ewing, the Under-Secretary of State for Air, explained that the changing technique of air defence had made necessary the streamlining of the defence system. This had reduced the system into a smaller number of high-powered radar stations, but the underlining fact is that there are now vacancies for new personnel at these stations.

Continuing, Mr. Orr-Ewing said that "some people have gained the impression that the R.Aux.A.F. has been fading away and become of lesser importance. This is not true. In fact we are about to launch a recruiting campaign at our 12 F.C.U.s based on Aberdeen, Dundee, Newcastle, Leeds, Hull, Peterborough, Norwich, Ipswich, London, Eastbourne, Bournemouth and Belfast."

R.A.F. Stations "At Home"

THIRTY-FOUR R.A.F. stations are to be open to the public on Saturday, September 20, in commemoration of the Battle of Britain. These are: **Buckinghamshire:** Halton; **Cambridgeshire:** Waterbeach and Bassingbourn; **Cornwall:** St. Eval; **Devon:** Chivenor; **Glamorgan:** St. Athan; **Hampshire:** Andover and Thorney Island; **Huntingdon:** Upwood; **Kent:** Biggin Hill; **Lancashire:** Weeton; **Lincolnshire:** Binbrook and Waddington; **Nottinghamshire:** Syerston; **Northumberland:** Acklington; **Norfolk:** Horsham St. Faith and Marham; **Oxfordshire:** Benson; **Rutland:** Cottesmore; **Shropshire:** Cosford and Ternhill; **Suffolk:** Honington and Wattisham; **Warwickshire:** Gaydon; **Wiltshire:** Colerne; **Yorkshire:** Church Fenton, Leeming, Lindholme and Norton; **Anglesey:** Valley; **Isle of Man:** Jurby; **Scotland:** Leuchars and Turnhouse; **Northern Ireland:** Aldergrove.

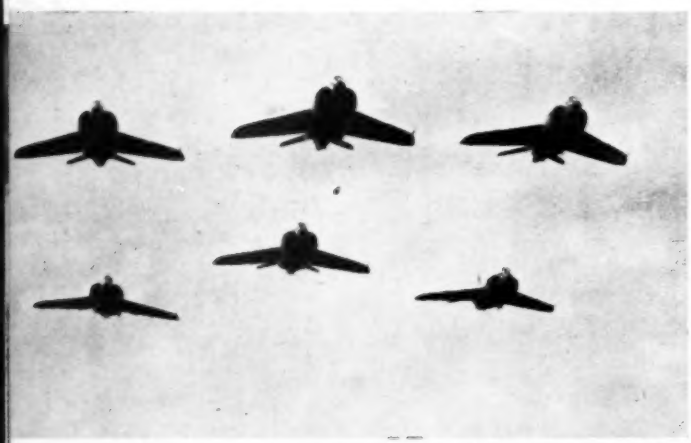
R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Group Captains: T. E. J. Fitton to Air Ministry for duty in the Department of the Air Member for Supply and Organization; R. F. L. Hart to Headquarters, Flying Training Command, for administrative staff duties; A. Hughes, D.F.C., to Warsaw as air attaché; H. P. Johnston, O.B.E., to Headquarters, No. 24 Group, for air staff duties; B. Samson, O.B.E., to Air Ministry for duty in the Department of the Air Member for Supply and Organization.

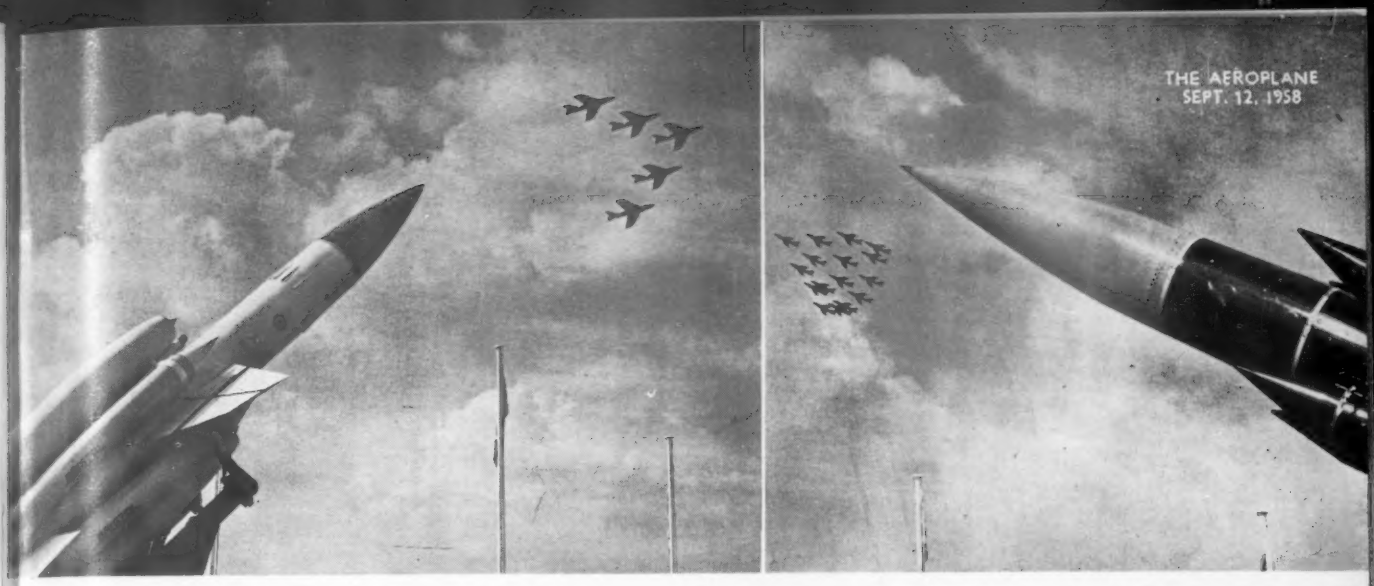
Wing Commanders: S. J. Bryant to Air Ministry for duty in the Department of the Air Member for Supply and Organization (with acting rank of Gp. Capt.); H. Bamforth, M.B.E., to R.A.F. Innsworth to command; J. Eames, D.F.C., to Air Ministry for duty in the Department of the Air Member for Personnel; L. B. Fletcher to Air Ministry for duty in the Department of the Air Member for Supply and Organization; F. Healey to R.A.F. Sylt for technical duties; P. W. Jamieson, A.F.C., to Ministry of Defence; R. F. Jones to Headquarters, Air Materiel Command, U.S.A.F.; F. J. Mowbray to Ministry of Supply; J. R. Musgrave, D.S.O., to Headquarters, Bomber Command, for training duties; D. A. Oxby, D.S.O., D.F.C., D.F.M., to R.A.F. West Raynham for operations duties; E. B. Panter, D.S.O., D.F.C., to A.A.F.C.E. for staff duties; J. B. Quarrington to Air Ministry for duty in the Department of the Air Member for Supply and Organization; A. Stevenson, O.B.E., to R.A.F. Akrotiri, Cyprus, to command No. 3 (Light Anti-Aircraft) Wing, R.A.F. Regiment; A. M. Taylor to R.A.F. St. Athan to command the Administrative Wing; J. E. Tipton, D.F.C., to R.A.F. Staff College, Bracknell, for directing staff duties; C. H. Wiggins to Air Ministry for duty in the Department of the Air Member for Personnel.

Squadron Leaders: B. Hamilton, D.F.C., A.F.C., to Headquarters, 2nd T.A.F., Germany, for air plans duties (with acting rank of Wg. Cdr.); R. M. Morton to Air Ministry for duty in the Department of the Air Member for Supply and Organization (with acting rank of Wg. Cdr.)



SERVICE FORMATIONS.—Left, the six Supermarine Scimitars of No. 803 Squadron, R.N., making a low level fly-past during the Farnborough Show. Below, the C.F.S. Jet Provost team touching down after completing its aerobatic display.

Photographs copyright "The Aeroplane"



Photographs copyright "The Aeroplane"

FLASHES FROM FARNBOROUGH

Aspects and Prospects

Forecast first flight dates available at Farnborough for two new civil projects were: A.W. 650 Argosy, first half of November, and Vickers Vanguard, end of November.

Control of blade-pitch angle for reverse thrust and ground manœuvring is a feature of the Vanguard propeller developed by de Havilland Propellers, Ltd.

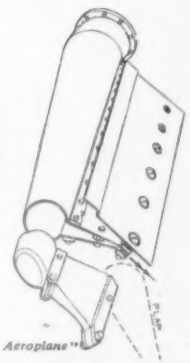
Following eight fatal accidents in recent months after ejections from 3,000 ft. or below, the R. Norwegian A.F. has asked the Martin-Baker Co. to study the possibility of installing their ejection seats in its American aircraft. An F-86F, an F-86K and an RF-84F have been flown to Chalgrove for design studies, although these were completed for the F-86K by Martin-Baker following a similar request by the R.Neth.A.F. 18 months ago. The Mk. 4 ejection seat can be accommodated fairly easily in these aircraft, although it may have to be scaled down slightly for some installations.

* * *

Inlet guide-vanes and stator blades are now formed in a new way by Wilmot Breeden, Ltd. They are made from nickel-chrome alloys in a succession of press operations from a flat blank. The trailing edges are brazed in a controlled protective atmosphere to very small tolerances so that there is a minimum of material to be removed and less chance of weakening the joint.

* * *

For use where turbojet engine operation and noise is to be simulated, F. G. Miles, Ltd., has produced a small turbojet simulator. This is operated by normal engine controls and produces the correct "noises off" when the "engine" is started, shut-down, re-lit or has afterburning added. Indication is given of appropriate fuel consumption, r.p.m., jet pipe temperature, operation of the afterburner, and so on.

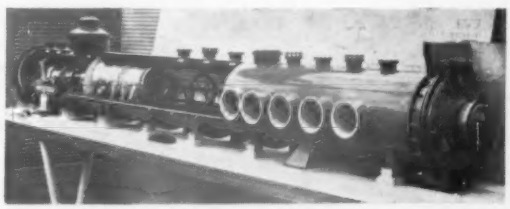


This assembly for the Supermarine Scimitar's blown flap system is made in titanium and was shown on the I.C.I. stand.

Drawing copyright "The Aeroplane"

* * *

New project announced by F. G. Miles, Ltd., at Farnborough was the H.D.M. 106T Turbo-Caravan, a version of the H.D.M. 106 to be powered by two 320 s.h.p. Turboméca Astazou turboprops.



PYESTOCK MODEL.—This model shows one of the two ramjet engine test-cells at N.G.T.E. Both are 12 ft. dia. and about 115 ft. long. Ramjets up to 24 in. dia. can be run in simulated flight conditions at temperatures up to 600°K.

FARNBOROUGH SECOND REPORT

This week we conclude our coverage of the Nineteenth S.B.A.C. Display and Exhibition. In these pages will be found additional photographs of the aircraft and equipment on show, in the air and on the ground, together with details and sketches of the newest and most interesting items of accessory equipment displayed. Wren contributes his own impressions of the show and on a later page are illustrated some of the visiting personalities. A full account of the aircraft, aero-engines, missiles and flying display at Farnborough appeared in our previous issue.

Farnborough Second Report . . . .

Missile Matters

Many visitors commented on the quiet efficiency of the cool white-overalled R.A.F. team demonstrating Bloodhound with the boot-stamping coming from the Army's hot khaki-clad Thunderbird crew.

* * *

The Gloster technical-developments division can offer missile designers a full range of systems for H.T.P., kerosene and compressed air.

* * *

The big-wing version of Fireflash is said to be suitable for use "up to the maximum altitude of any modern fighter."

* * *

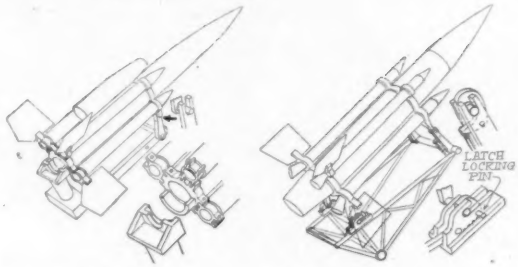
When two Seaslugs were fired in salvo from H.M.S. "Girdleness," recently, the first succeeded in hitting the target aircraft while the second hit the largest piece of the resulting wreckage.

* * *

A 16-mm. high-speed camera mounted on a quick-action tripod for missile tracking for long-distance observations was displayed by W. Vinten, Ltd. A modified version of the company's S.90 camera, it was fitted with a 36-in. telephoto lens and operates at 100 pictures per second.

These sketches show how Bloodhound and Thunderbird are located on their respective launchers.

Drawings copyright "The Aeroplane"



At guided weapons trials establishments in the U.K. and Australia more than 500 missile flights for Bloodhound development have been made.

* * *

Long-term compatibility with high-test peroxide is a feature of the Hymatic PS 64/6 Mk. 3 valve. The PS 64 range has been extended by valves capable of accepting inlet pressures up to 4,500 p.s.i.

* * *

The workforce engaged on the Bristol/Ferranti Bloodhound weapons system is larger than that for any other comparable project in Western Europe. Six U.K. factories are committed to its manufacture.

A free-piston ultra-high-pressure intensifier has been produced by the Gloster technical-developments division as part of the ground equipment for a missile. Nitrogen supplied to a missile site at 800 p.s.i. can be pumped into the missile's storage tanks at 6,000 p.s.i. by the intensifier, which will operate on hydraulic pressures of 600-1,700 p.s.i.

* * *

High-accuracy interferometer equipment is being produced by the Ferguson Radio Corp. for missile and satellite tracking. This equipment, developed in conjunction with the radio department of the R.A.E., is said to be more accurate than any other of its type.

Navaid Notes

A large diagram at the back of the Sperry stand showed the layout for a completely integrated and duplicated instrument and automatic control system for large transport aircraft. Amongst other items, Sperry showed eight different types of gyro horizon, including two specially developed for helicopter use with adjustable datums for hovering and cruising flight, and the new altitude control unit and controller for the A.L.30. autopilot.

* * *

The entry of English Electric into the inertial navigation field was demonstrated by the appearance of floated gyro units of miniature dimensions on an additional stand in the static exhibition. These Minneapolis-Honeywell units, now being built under licence, are almost ridiculously small and the amount of work involved in their development and manufacture can be gauged by saying that they are "worth their weight in platinum"—more or less.

* * *

This year the Decca DIAN Doppler was shown in action on the stand with speeds and headings fed into the computor to provide the appropriate indications on the meters and the Flight Log.

* * *

The main exhibit on the S.G. Brown stand was a demonstration example of the Mk. 1 Master Reference Gyro which, when in action, operated a roller-blind horizon and heading indicator. But beside this display was a smaller unit—the beginnings of the new Mk. 2 M.R.G. in which, by a redisposition of units and other means, has been reduced considerably in overall dimensions and in weight from 40 lb. to about 20 lb. A gyro wander rate of about 1° per hour is expected from this unit, with an erection time-constant of about two minutes and an accuracy of vertical reference of 0.2°.

The Sperry Gyroscope Co., Ltd., flew an experimental inertial navigation system, developed by British engineers for manned fighter applications, nearly four years ago. On the Sperry stand was to be seen an early design of stable platform—actually the equipment used on the first flight in 1954. The system was developed in collaboration with the M.O.S. and R.A.E.

* * *

One of the radio items to be seen at Farnborough for the first time was the Ekco Type CF. 178 automatic VHF/ADF which was demonstrated on the outdoor site. Using a rotating Adcock aerial, the system uses new methods for deriving bearing and sense information and is both simple and inexpensive. Bearing indications are shown without ambiguity, as QDMs or QTEs, by a single radial trace on a cathode-ray tube.

* * *

Ferranti showed a new design of vertical reference gyro, the F.S.16, to provide pitch and roll signals for flight instruments and equipment. All components are contained in a case 4½ in. in diameter and 9 in. long. The 5½-in. stand-by artificial horizon and newly developed stand-by directional gyro were also shown. The horizon is now in quantity production and has been specified by B.O.A.C. and B.E.A. for use in their Comets and Vanguards.

* * *

The demonstration of the working of the Kelvin and Hughes Flight Data System showed a display in which the altitude and vertical speed indications on the left had reverted to the normal dial-type presentation. The first version had a tape system for these displays. The demonstration showed the F.D.S. indications throughout a typical sortie—speeded up 10 times in order to pack the programme into a reasonable length of time.

Elliott Brothers (London) showed components of an autopilot system for fighters which provides three-axis autostabilization, a manœuvre-holding facility (using reference data stored in the computer unit) and an automatic instrument landing system coupler. Also demonstrated was the E-RCB-2 sub-miniature radio compass, weighing only 15 lb. complete (which is being made under licence from Air-Equipment) and units for the 21-series Bendix transistorized lightweight VHF 360-channel communication and navigation system with ILS and VOR facilities.

* * *

Four items of lightweight airborne equipment on the stand of Standard Telephones and Cables, Ltd., were new so far as Farnborough is concerned. These were the combined VHF/ILS/VOR transmitters and receivers; new lightweight audio control and intercommunication equipment; a sub-miniature radio altimeter; and the airborne radio teleprinter. All these pieces of equipment are transistorized. Other new standard equipment exhibited were the Commutated Antenna Direction Finding installation, in an air-transportable container by Airtech, and the STRAD telegraph retransmission system, which is installed at Gatwick.

* * *

With the air traffic radar demonstration equipment Marconi showed also their new SNW 51 storm detection radar equipment in action. The works in the 3 cm. ("X") band to show on a PPI the location of storms and rain-producing clouds up to ranges of 200 miles. Scanning speeds between seven and 21 r.p.m. can be used, the vertical beam width is 4° and the scanner can be tilted through 12°.

(*Continued on page* 423)

Farnborough Second Report . . . .

Electrical Equipment

The Sperry Gyroscope Co., Ltd., is manufacturing and marketing an eddy-current flaw detector under licence from I.C.I., Ltd. Known as the Sperry Introview, the flaw detector will indicate small cracks, corrosion and thinning of material as well as major flaws. The instrument is particularly suitable for testing non-ferrous tubes and sections.

* * *

Exhibited for the first time is a range of AC actuators by the Plessey Co., Ltd. They include linear and rotary models, certain of which will be used on the Vickers Vanguard—the first civil aircraft with AC actuators.

* * *

A new development by Sir George Godfrey and Partners, Ltd., is a duct frost guard. This prevents the formation of slush and ice in aircraft air-conditioning systems when air is delivered from the cold-air unit below freezing point. Ice formation in the frost-guard unit increases the back pressure at the turbine outlet, which results in the temperature of the outlet air rising.

* * *

Dowty Nucleonics, Ltd., has developed what is claimed to be the first British lever switch for the selection of undercarriage position. A two-position unit, the switch has an internal lock which prevents selection when the aircraft is on the ground, with a twist override for emergency use.

Ground Equipment

Rollason Aerocessories, Ltd., exhibited their latest mobile heating and spraying plant for use with Kilfrost D.C.2 compound for the de-frosting and protection of parked aircraft against ice formation. With a tank capacity of 50 gal., the plant has a delivery rate of 1½ g.p.m. at 100 p.s.i. Fluid heating is undertaken by three thermostatic controlled 5-kW. immersion heaters.

* * *

Strabor, Ltd., has developed retractable passenger-entry steps suitable for all marks of Viscount. Operating on the "lazy-tongs" principle, the stairs fold up inside the aircraft without blocking the doorway. The unit, known as the Airscalator, weighs only 189 lb. complete with its operating mechanism. Two of these units are now being assessed by B.E.A.

* * *

Rellumit (London), Ltd., displayed a motorized overwing hydrant dispenser which can be operated by one man. Equipped with automatic hose wind-in and out, the dispenser has a hydro-pneumatic powered ladder fitted with a proximity detector. Attached to the front of the ladder, the detector locks the clutch and brakes if the dispenser is driven too close to the wing of an aircraft. This override control can only be unlocked if reverse is engaged and the vehicle backed away.

Denis Ferranti Motors, Ltd., showed the latest developments in their range of Eargard ear defenders in the form of headphone-equipped units. The company also displayed a new constant potential battery charger for silver-zinc batteries used in missiles and other applications. With a reference voltage of 0-400 V. and a current range of 0 to 400 amps., the equipment provides a high degree of stabilization.

* * *

The second prototype of a new range of portable test trolleys for the ground-testing of pressurized aircraft was exhibited by Normalair, Ltd. These units are for testing individual components of the aircraft's system, such as the maximum differential control, without having to pressurize the complete aircraft.

* * *

Self-propelled aircraft-embarkation steps were on the outdoor display site of H. W. Edghill and Co., Ltd. Known as the Autostair Mk. 2, the unit consists of a support frame carrying steps and platform mounted on an Austin 152 commercial vehicle chassis. The steps are raised and lowered electro-hydraulically by means of controls in the cab which are coupled to indicator lights for the operating sequences. The platform height can be varied between 8 ft. 4 in. and 11 ft. 8 in. and the min. overall height is 12 ft. 1 in.

The Strabor, Ltd., Airscalator Mk.7A, designed for the Viscount 700 or 800, in the fully-folded position showing how little space is taken. The Airscalator was exhibited on the stand of J. Stone and Co. (Charlton) Ltd.

Photograph copyright "The Aeroplane"

A prototype mobile oxygen-producing plant was shown by British Oxygen Engineering, Ltd. This piece of rocket-site equipment is also suitable for producing nitrogen.

Airframe Accessories

A new type of flame detector has been developed by the Graviner Manufacturing Co., Ltd.; it is to be used for engine flame-out detection on a naval aircraft. The detector depends for its action on gas ionization in flame. It has a silicon carbide electrode and will operate in engine jet pipes at temperatures up to 1,500° C.

* * *

Plannair Ltd., has produced a four-stage axial blower unit for cockpit and equipment cooling on the Blackburn NA.39. The blower operates at 14,000 r.p.m. and moves 270 cu. ft. of cooling air per minute.

* * *

New freight-handling equipment, known as lift and roll units, has been developed by Electro-Hydraulics, Ltd. Each unit is a portable jack with a shock-absorber wheel assembly. Two or more of these units can be rapidly attached to a suitable container or crate; after jacking, the container becomes a wheeled unit for ground handling.

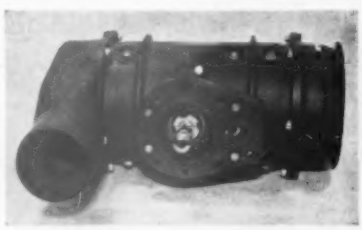
Largest of the fuel pumps shown by Joseph Lucas (Gas Turbine Equipment), Ltd., is the MGTD series used on the Rolls-Royce Conway. Rated flow is 2,600 gal./hr.

* * *

Latest type of fuel gauge shown by Smiths Aircraft Instruments, Ltd., is the Type 4, being developed by Weymouth Gauges and Instruments, Ltd. This small gauge has a fully transistorized amplifier unit and is combined with an indicator dial. It can be installed with separate amplifier and indicator if required.

* * *

British Oxygen Aro Equipment, Ltd., has developed a liquid-nitrogen system for explosion suppression. A system of this type is necessary for aircraft which operate at speeds where aerodynamic heating may induce explosive conditions. The liquid-nitrogen system gives continuous protection as compared with the "one-shot" protection provided by chemical systems. Its installed weight is 12 lb. per 1,000 gal. of fuel.



Produced by Plannair Ltd., this four-stage axial blower is used for cockpit and equipment cooling on the Blackburn NA.39 strike aircraft.

Sir George Godfrey and Partners, Ltd., has developed a large water extractor, which also acts as a silencer, for the Vickers Vanguard. It removes moisture from the air supplied to the air-conditioning and pressurization system and also attenuates the noise from the cold-air unit.

Wroundabout Farnborough

Viewing the bulging and clinking company enclosures, a test pilot sadly commented: "This place is getting like an enormous night club, with a flying display instead of a floor show."

✱

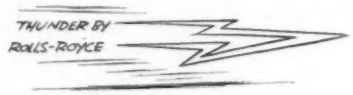
Forced Laugh Dept. "The difference between summer and winter in this country is that in the summer the rain is warmer."

✱

That old Comet has been parked, or rooted, near the end of the runway for so long that it's time Oliver Stewart referred to its immediate area as Comet's Plain.

✱

"Bea" Beamont tells me he made good use of my last-week's diagram of his Farnborough flying. He stuck it all round inside the canopy, he says, and followed it meticulously, though finding some of the turns a bit Rate 10-ish. The 2-seat trainer version of his aeroplane may be called the Lightning Conductor, he didn't say.

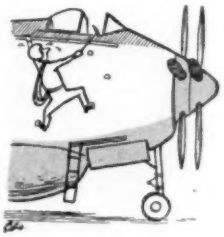


✱

On the Tuesday, Treble-One had organized even the atmosphere, nicely positioning the clouds and injecting just the right touch of humidity to touch off wing-tip trails. Speaking of trails and smoke-making, it's not true that 800 Sqn. have on their strength a Leading Stoker.

✱

"Flying the Gannet is easy," says Roy Morris, Fairey test pilot—"getting in is the hard part."

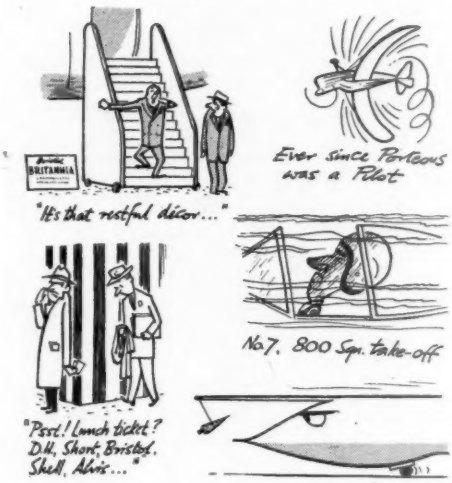


✱

Just before the Display week, I flew in the Comet 4 and so, I discovered, did a wasp. I now claim to be the first cartoonist to be stung at 30,000 feet. So uneventful was the smooth flight that other pressmen aboard gratefully recorded this scrap of useless news.

✱

Lt. Col. C. "ANDY" ANDERSON Ops. Officer Flt. Test Directorate, Edwards A.F.B.
Capt. BOB WHITE who will pilot the X-15 "space-plane"
ALEC JOHNSTON PRO. S.B.A.C.
BARRY RADLEY HUNTING Deputy Chief Test Pilot
"TAD" CIASTULA Chief Designer Helicopter Div. SAUNDERS-ROE
GORDON STRINGER Director of Public Relations CANADAIR


BRITANNIA
"It's that restful décor..."
Ever since Porteous was a Pilot
No.7. 800 Sqn. take-off
"Psst! Lunch ticket? D.H., Short, Bristol, Shell, Avro..."

✱

"The Comet 3a? Ah, yes, that's the one with the sawn-off seats and reclining wings. . ."

✱

Tea and Sympathy. If the quantity of company Press releases available in racks, bundles, stacks and heaps in the huge Press Tent keeps growing at the present rate there will soon be no room for the pressmen. And speaking on behalf of all those pressmen, blessings on the heads of S.B.A.C. Press Officer Alec Johnston and his staff for their help, hospitality and hand-outs.

✱

One of the aerobatting V bombers was said to be flying so light it taxied in on the fumes.

✱

What a pity there was a crosswind blowing away from the spectators on most days, so that they were denied the delight of being perfumed by the lavender water from the Auster Alpha's Micronair Atomisers.

✱

There was a suggestion that one of the crop-sprayers would have been particularly welcome if it could have sprayed Alka-Seltzer over the company enclosures around the middle of the afternoon.

✱

Reminiscing. "In those days we only had two customers, both of them angry—now we have hundreds."

✱

Feathered Wren. Wondering which aeroplane I might fly in at the Display, I heard that the Hunting President had not had, in tens of thousands of hours, a single case of the most minor structural failure and being naturally cautious, I found this rather appealing. With Barry Radley's kind co-operation, I sat next to him for the occasion. Alas, no wasps. Just an easy bit of feathering and one-engine flying.

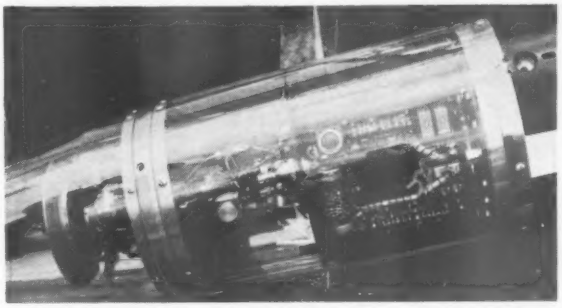
by Crosby

Farnborough Second Report . . . .

Guided Missile Equipment and Components

FOR those whose interests lay in or around the guided-missile business there was a wide range of things to be seen in the static exhibition among the company's stands—more, perhaps, than on previous occasions. One was left with the impression, however, that while there might not have been as many complete systems as were displayed last year, there were at least more individual components; certainly there was a much higher proportion of electronic equipment on show.

But despite this there was no great wealth of information to be obtained. In view of the obviously more favourable official attitude toward showing missile details, it seemed more than a pity that this did not extend to the release of more facts. In nearly every case only the briefest of "cleared" captions or, at best, a short statement was all that could be obtained from the manufacturers' representatives—who were as frustrated by the restrictions as the inquirers. Here we give a summary of some of the things to be found on show.



The Elliott Mk. 3 homing head on the latest Short G.P.V.

As one would expect, by far the most numerous among the missile "equipment" exhibits were the various electronic displays ranging from complete systems down to individual miniaturized components. Among the former was the Mk. 3 homing head by Elliott Bros. (London), Ltd., for the Short general-purpose test vehicle. This was to be seen in detail within the Perspex nose cone on the vehicle itself.

Compared with the Mk. 2 head shown last year, this latest version embodies a number of refinements which have enabled the weight and overall size to be much reduced. For example, printed circuits are now used and make a more compact electronic section; the gyro/gimbal system has been revised; and the hydraulic system operating the scanner has also been simplified. All of this must have reduced the weight of the complete head by some 30% or so.

Some of the electronic sections of the D.H. Firestreak were shown on the Plessey stand. These included the power pack which operates from a 2.4 kc./s. supply and provides a stabilized DC output for the missile's guidance and control systems. An altitude repeater slave unit, by means of which control circuit gains with altitude can be varied, was also shown. The third main Plessey Firestreak component on show was the control unit which translates the guidance information into signals for operating the control surfaces.

All of these were excellent examples of what can be done to get a complex unit into a very confined space—and just to indicate how it was achieved, a series of very small component parts or sub-assemblies from these main units was shown as examples of the use of recent encapsulation techniques.

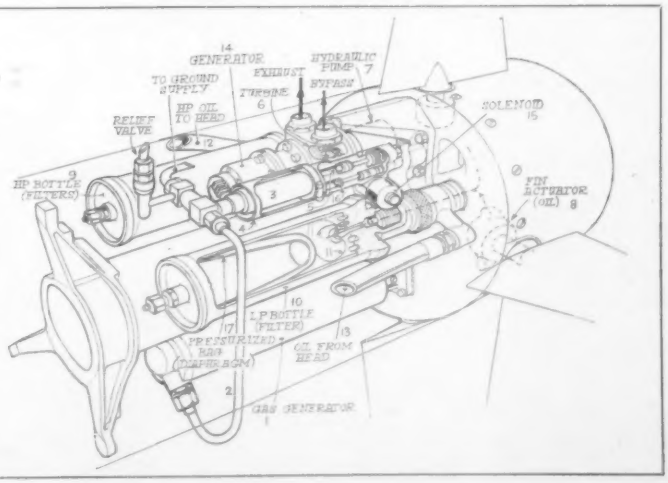
This "potting" of the components in a plastics material to protect it from vibration and atmospheric changes is done by Plessey with Sebalkyde ground to a powder and poured into the component to be encapsulated while in a frozen state. By agitating it as it thaws out this material changes from its powder form into a foam compound which sets into a light and satisfactorily firm filling. Final sealing off of the encapsulated unit is done with Araldite.

Another company using Sebalkyde in encapsulated electronic components is Cossor, who were showing a number of small units of this type. These were not labelled as part of any particular application, but it was explained that they were suitable for guided weapons. Also in this category was an interesting magneto-strictive delay line for providing any required delay in a circuit up to about 25 micro seconds; choice of delay is given by semi-adjustable pick-off points. This unit is about 7 in. long by ½ in. square and has a nickel delay line.

A particularly interesting exhibit on the Cossor stand, and one which would seem to have obvious missile application within a frequency band of 1 to 11 kilomegacycles, was a new printed waveguide. This was said to be the first such waveguide available to the industry and would show worthwhile advantages over present waveguides on the score of space, weight, cost and reproducibility. The required waveguide configuration is printed on silicon glass-fibre laminate and is spaced off between two metallic ground planes.

As the other partner in the Bristol/Ferranti partnership in the Bloodhound weapons system, Ferranti, Ltd., has been responsible for the guidance and control system, electronic functional test equipment, and fire control equipment. All this effort was much in evidence at the Show although, it seems, Security has prevented any detailed display of it. Indeed, on the company's stand a large coloured illustration of a ground radar installation incorporated a censor-removed scanner; and, we were told, one of the components planned for showing had perforce to remain locked up in the cupboard on the stand.

Associated, too, with the Bloodhound and Thunderbird type of missiles, which employ a semi-active homing system, is the



THUNDERBIRD CONTROL.—Details of the control fin actuation for Thunderbird seen on the English Electric stand. Gas from 1 via 2 to 3 with its heat-shield 4; thence past valve 5 to drive turbine 6. Turbine drives pump 7 to work actuators 8 with oil via filters 9. Return oil through filter 10 (porous bronze filter 11). Oil take-off at 12 to head and return at 13. Generator (14) is driven off turbine 6 for electrical supply. Solenoid 15 opens by-pass valve 16 to reduce (regulate) turbine speed. Compressed air in bag 17 to maintain head on oil pressure.

Drawing by J. H. Clark, A.R.Ae.S
copyright "The Aeroplane"

Farnborough Second Report . . . .

"Sting Ray" target-illuminating and tracking radar produced by British Thomson-Houston. As in so many cases, other than a brief statement explaining what it sets out to accomplish, no detailed information was forthcoming. Nor were any pieces of associated equipment to be found on the company's stand—although one or two very small examples of electronic radar components, similar to items used in Sting Ray, were displayed.

On the E.M.I. Electronics stand were shown a telemetry transmitter for Bloodhound research rounds. This information unit has a maximum of 24 channels, each function being sampled by a high-speed rotary switch operating at 6,000 r.p.m. and passed on for modulation before being fed to the missile aerial. This transmitter receives its electrical supply from a battery-operated power unit also shown.

A similar transmitter/power unit built up as a single assembly was also being shown and this was said to be for "another surface-to-air weapon." This makes use of the same components as in the Bloodhound equipment but the power supply section is not battery-operated; it receives AC power from the generator already installed in the missile and converts it to DC.

The third E.M.I. missile exhibit was a small telemetry test set for pre-launch checks of guidance and control systems.

Marconi's radar division were showing their electronic velocity analyser which can be adapted for measuring guided weapon speeds up to 3,000 ft./sec. It operates in the X-band and can be used on "projectiles" presenting an effective radar reflector area of only $\frac{1}{4}$ m.^{2}

Examples of a different sort of test apparatus for guided weapons were on the outside Seaslug display. Flanking the missile were exhibits "representative" of ship-borne test gear in the form of groups of large cabinets of electronic equipment. Of these, Sperry has been responsible for the control-system group and General Electric for the guidance system group; no details were obtainable.

On the G.E.C. inside stand were displayed some examples of their fabricated dip-brazed aluminium waveguides. These have been developed specifically to meet demands for smaller and lighter units and would appear to have a useful application for missile equipment. Specially coated aluminium sheet, punched and assembled by a system of interlocking tags and slots, is used for these components.

Other new G.E.C. components with missile application would seem to be their lightweight high-voltage transformers and chokes. These make use of organic casting resins as a filler instead of oil and this, it is claimed, results in a more compact and much lighter component.

A number of very small batteries especially intended for guided missiles were to be seen on show and as one would expect, their quoted performance showed a noteworthy ratio of output to weight—and volume. Chloride Batteries, for example, had a 12-V. 4-amp.-hr. battery weighing 4$\frac{1}{2}$ lb. and capable of delivering 75 amp. for a short time. An 8-V. version was also shown weighing 3 lb. 6 oz.; and there was a 2-V. 8-amp.hr. battery weighing 1 lb. 5 oz. and capable of giving 70 amp. for 1$\frac{1}{2}$ min.

Some extremely small silver-zinc accumulators were being shown among the Venner display. The examples exhibited ranged in capacity from 4 to $\frac{3}{4}$ amp.hr. with units in between giving 20, 7$\frac{1}{2}$, 4 and 1$\frac{1}{2}$ amp.

Several batteries associated with guided-missile work were displayed by Burndept, but apart from one 300-V. unit said to be for de Havilland Propellers, and by reason of its segmental shape clearly intended for the Firestreak, they could not be related to any particular application. One unit was particularly interesting in that it was a 300-V. unit made up of more than 500 cells and electrically heated by thermostatically controlled mats located between the banks of cells.

Surprisingly enough, quite a lot of Firestreak airframe components and associated operational equipment were displayed on the de Havilland stands. Among the former, for example, were a control fin of phenolic asbestos moulded direct to a metal spade insert; and a main wing and a tail fairing also of phenolic asbestos. In all these components the standard of finish was exceptionally high.

On the company's main stand were set out the principle aircraft-carried equipment associated with the Firestreak. These included the hydraulically operated scanner unit which appeared to be similar to the one displayed last year. Power supply to the missile prior to launch is controlled in frequency and voltage to ± 1% and comes from a hydraulic motor alternator, condenser and controller system. Fire-control equipment comprises a power unit, slaving unit and launching sequence unit which provide control computing and monitoring services before launching the missile.

Also displayed was a heating pack which keeps the Firestreak's equipment at a closely controlled temperature while it is attached to the aircraft. This unit is essentially a heat-exchanger with a by-pass valve operated by a pressure actuator which in turn is controlled by a proportional solenoid and bi-metal elements.

A great many of the component companies had equipment that would find application in missiles of one sort or another. Among these, for example, was Dunlop, who produce a range of control valves and actuators for use in this field. A typical unit, designed to occupy the minimum space, is a pressure-reducing valve which is fitted inside a compressed-air container; inside the body of the pressure-reducing valve is a miniature solenoid-operated valve. With this equipment a constant flow from the container is maintained to the stage when the bottle pressure is nearly down to the pressure setting of the valve.

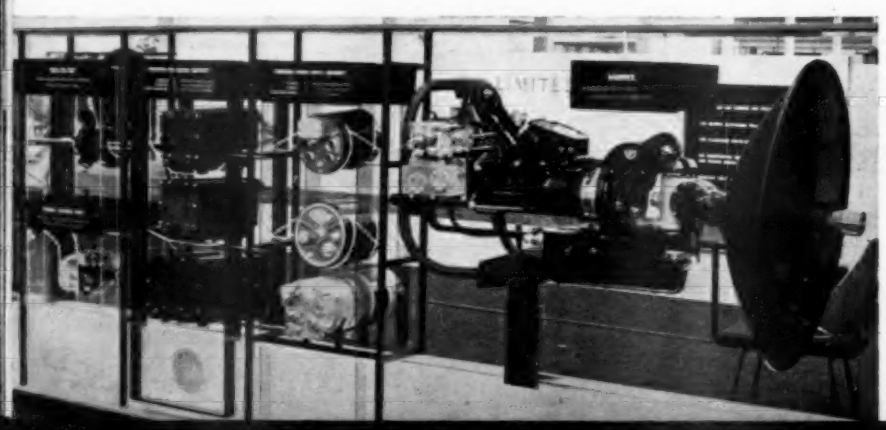
Dowty Equipment, too, have an interest in guided missiles, and among their products suitable for work in such devices is the Dowty Moog servo valve. Built under licence from the Moog Valve Company, Inc., of America, this is a very neat little electro-hydraulic unit in which the hydraulic flow output is proportional to the electrical input. It operates on hydraulic fluid at 1,000-4,000 p.s.i. and comprises a polarized electrical-force motor and two stages of hydraulic power amplification.

Seen for the first time in public in this country was the miniature integrating gyroscope made by English Electric under licence from Minneapolis-Honeywell. These incredibly accurate and beautifully made units are of particular interest to the inertial navigation specialist.

Wiring and circuit connections play an important part in all guided-weapon electronics for there are still many instances where the newer printed circuits are not suitable. In this direction Belling and Lee were showing some typical examples of sundry Seaslug electronic circuit looms making use of their plugs, sockets and similar components. Similarly British Insulated Callender's Cables indicated on their stand that they also are among the suppliers to the new industry.

Of particular value in guided-weapons trials is the wide-angle camera designed by the Australian Weapons Research Establishment at Woomera and developed and produced by Fairey's Australian company. The lens has a field of view of more than 180° and in the Jindivik target aircraft these cameras are mounted in pairs in wing-tip pods or leading-edge fairings; in each pair one camera is set facing vertically upwards and the other vertically downwards.

As we said in our first report on the guided-weapon exhibits at Farnborough (THE AEROPLANE for September 5) there were few signs indeed of the high-altitude research vehicles. Certainly there was no evidence of any activities by the astronautical community. However, these aspects of the S.B.A.C. Shows of a later day were not overlooked at Farnborough this year—for Shell-Mex and B.P. on their stand included an imaginative and attractive lunar landscape model showing a survey party hard at work after arrival by interplanetary vehicle.—F.T.M.



Aircraft-carried equipment associated with Firestreak was shown on the main de Havilland stand. It included a scanner unit, power supply and fire control equipment, and a heating pack. The scanner is a search and lock-follow unit.

Photograph copyright "The Aeroplane"

Farnborough Second Report . . . .

Static Show Aircraft News

FOR the visitor to Farnborough with sufficient time to spare, a considerable amount of information was to be obtained in the biggest-ever static show about some of the aircraft industry's newer projects, as well as the current range of aircraft. In most cases, these new projects were represented by models on the stand, or by illustration; although one or two plans, still a little nebulous, were for the ears of privileged visitors only, and were not publicly proclaimed at all.

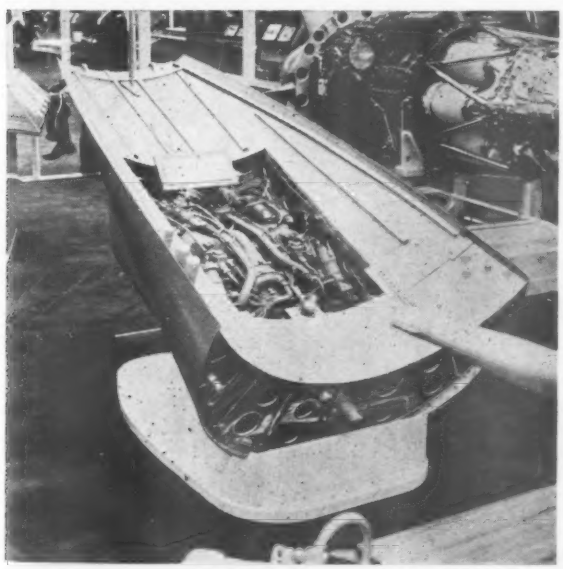
The notes which follow, arranged, for convenience, alphabetically under aircraft names, cover the new and most interesting information made known by the aircraft manufacturers in the static exhibition.

Airco D.H.121.—Models of B.E.A.'s new short-range turbojet were shown by de Havilland, Fairey and Hunting, jointly concerned in the D.H.121 programme. Few new details of the aircraft were available, except that the model on the D.H. stand gave an impression of a possible layout, with 20 seats five-abreast in a first-class lounge forward, separated by washrooms from a 72-seat tourist-class lounge with six-abreast seating.

The first D.H.121 is expected to fly during 1962, by which time Rolls-Royce should have been running the R.B.141 engine for more than two years. The R.B.141, with an initial rating of 12,000 lb., will be based upon the Conway, although scaled down to have a smaller diameter. It will also have a greater by-pass ratio than the Conway, and, Rolls-Royce claim, "a specific fuel consumption and a noise level, without suppressors, much lower than any existing engine of comparable thrust."

De Havilland have recalled, incidentally, that one of their earliest design studies leading to the Comet featured three engines in the rear fuselage—in this case the lay-out being a twin-boom type.

Blackburn NA.39.—The large model of this aircraft which surmounted the Blackburn stand revealed little not already seen in photographs of the aircraft or in the flying display. The first NA.39 had flown about 25 hr. up to the beginning of Farnborough week, while the second of 20 ordered so far made its first flight on August 26 and, on its second flight, flew down to Farnborough. There, behind locked doors, it was inspected by suitably "screened" visitors—among them, on September 2, Admiral of the Fleet Lord Mountbatten and Mr. Duncan Sandys. The blue and white finish, incidentally, on both these prototypes is for display purposes only.



This pack containing a Napier Double Scorpion rocket motor has been developed for the English Electric Lightning on which it is soon to be test flown.

Blackburn B.107A.—A sectioned model of this project appeared on the Blackburn stand to demonstrate its large capacity and ease of loading. Known as "Beverley Development, Stage 3" the B.107A has evolved through several design stages to its present form, where only want of an order prevents its immediate construction. Basic characteristics of the B.107A were given in THE AEROPLANE for August 29. While utilizing many Beverley components, it is quite considerably modified in many respects, including the pressurized fuselage and retractable undercarriage.

Production of the Beverley itself—not shown at Farnborough this year—has now ended, just short of 50 aircraft, although Blackburn are still concerned with developing rocket-assisted take-off, heavy dropping and the normal modification programmes.

Bristol 205.—This is the designation of a current design study which the Bristol Aircraft personnel were busily discussing with airline executives during Farnborough week. Still in the formative stage of project design, this type is envisaged in the Viscount/Convair 440 replacement category, seating up to 58 passengers and cruising at about 550 m.p.h. over short ranges—say, from 200 up to 1,400 miles. It would be powered by four Bristol Orpheus turbojets of about 5,000 lb.s.t. each, and would have a very good field performance.

Bristol Turbo-Ramjet Project.—Bristol Aero-Engines are backing a mixed powerplant concept—combining the turbojet and ramjet—for supersonic aircraft at above Mach 2.5. A brochure issued at Farnborough set out the advantages to be obtained by combining these two types of powerplant in, for instance, a supersonic airliner.

A very hypothetical scheme for such an aircraft shows a tailless delta wing layout, with rectangular-section fuselage containing three vertical pairs of turbojets and two ramjets between. Such an aeroplane would take-off on the turbojets, with the ramjets turned on at about Mach 0.7 in the climb and fuel increased until at Mach 2.0 the ramjets would be contributing most of the thrust. At cruising height and speed (e.g., 80,000 ft. and Mach 3.0) both ramjets and turbojets would be throttled back to economical cruising conditions. Bristol Aero-Engines calculate that the combined ramjet/turbojet weight required, for an aircraft designed to cruise at Mach 3.5, is half the plain turbojet weight; for a given take-off weight, the payload is markedly increased over equal ranges.

English Electric Lightning.—In addition to two prototypes of the P.1B, six of the pre-production batch of 20 Lightnings are now flying, and it was one of these taking part in the flying display. The 30% increase in fin area visible in the aircraft shown is to be applied as standard on all Lightnings.

A display on the English Electric stand showed a typical Lightning flight plan and listed alternative Lightning rôles:—

Long-range pursuit-course interception with subsonic or supersonic cruise;
Short-range high-speed pursuit-course interception;
Short-range patrol and pursuit-course interception;
Low-level ground attack photographic reconnaissance;
High-speed high-altitude photographic reconnaissance;
Collision course interception and patrol.

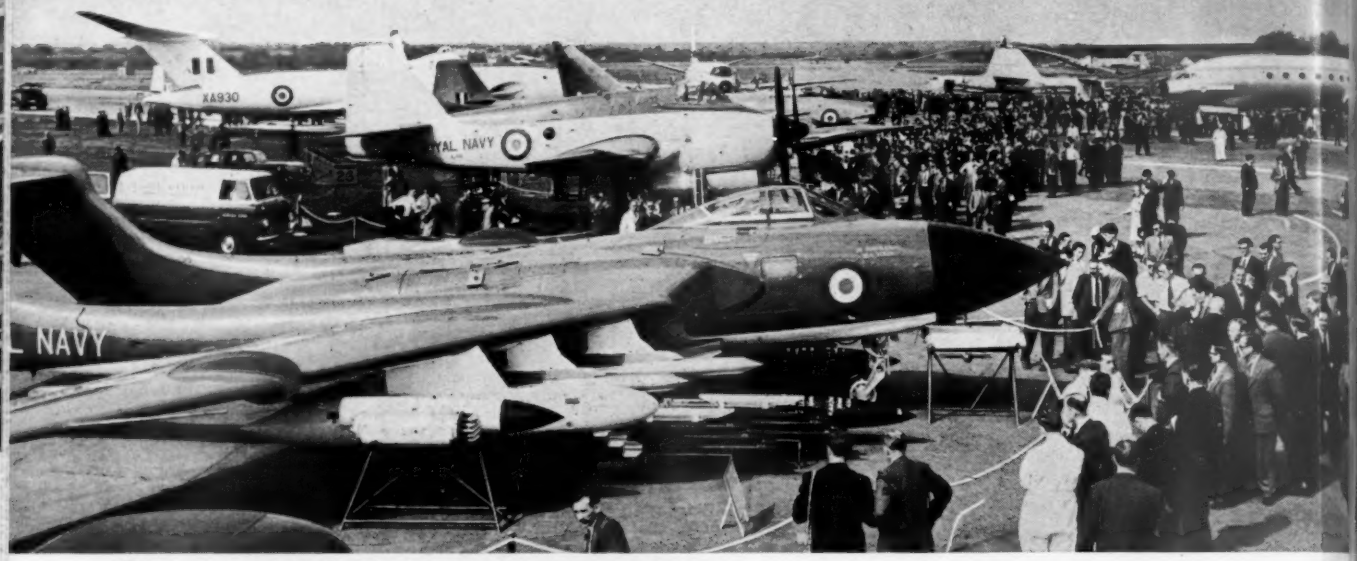
For these various rôles, alternative armament is being developed for the P.1. In addition to two 30-mm. Aden guns above the nose intake, the Lightning will carry either two more Adens in the lower front fuselage, two Firestreaks, two Microcell retractable packs each containing 24 2-in. air-to-air rockets, or a camera pack for reconnaissance duties. Adens and Firestreaks have been air-fired from the Lightning—but not, as yet, the Microcell rockets.

Across the way from the English Electric stand was an example of the Lightning's RA24R engine on the Rolls-Royce stand, and of its Double Scorpion ventral rocket pack on the Napier stand. The latter is an alternative to the ventral fuel tank, and is shortly to be flight tested on a P.1B, following the satisfactory conclusion of all ground tests.

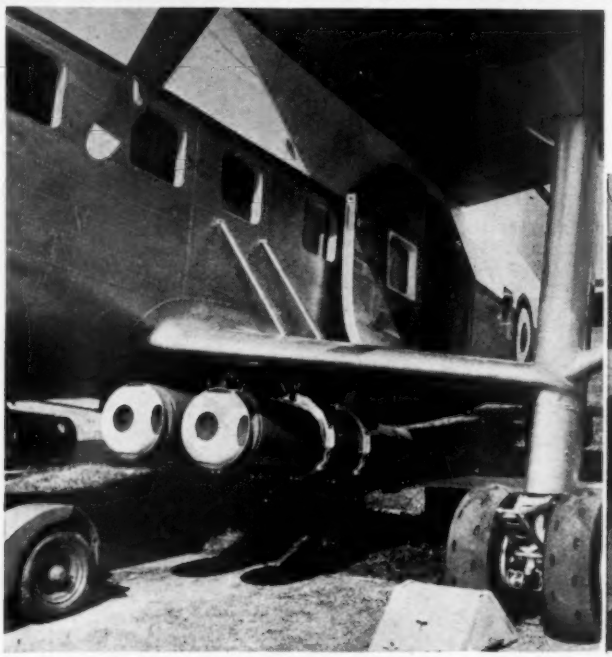
The Double Scorpion is intended to give the P.1 a higher operating altitude and/or better level speed, and the pack contains the entire engine installation and the hydrogen peroxide tank. Kerosene is drawn from the aircraft fuel system.

Power developed by this rocket engine has not been revealed

(*Continued on page* 430)



Above, this variety of Service aircraft includes the D.H. Sea Vixen FAW.1, the Fairey Gannet AEW.3 beyond it, with the tail of the Handley Page Victor B.1 in the left background.

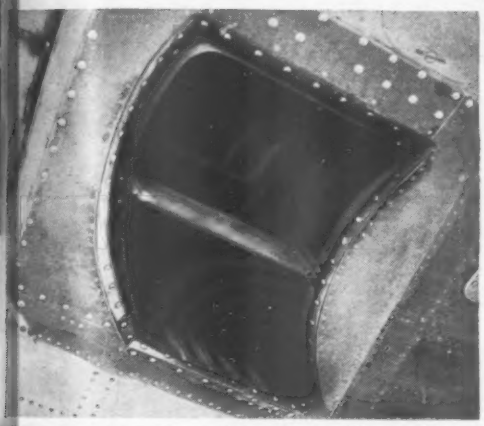


Left, supply containers under the stub wings of the Scottish Aviation Twin Pioneer CC.1.

Left, the new tail unit of the English Electric Lightning F.1, which has a 30% increase in fin area.

Below, the Hunting President supplied to the M.T.C.A. for radio communications calibration.

Round the Static Parks



Above, Short's SC.1 VTOL aircraft, publicly seen for the first time.

Left, one of the thrust reversers on the D.H. Comet 3B.

Photographs copyright "The Aeroplane"

Above, the D.H. Chipmunk 23, modified from the standard aircraft for agricultural work.

Left, a general view of the outside equipment exhibition.

Below, in the foreground is the saw-tooth Hawker Hunter F.6, with its comprehensive underwing stores displayed.

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(*Continued from page* 427)

but, remembering that the N.R.E.17 from which the single Scorpion was developed gave some 2,000 lb.s.t., a total power of between 6,000 and 7,000 lb. for the developed twin rocket does not seem unreasonable. The unit is cleared for two hours' operation, and is "lifed" at 20 hours.

At the S.B.A.C. Display next year, English Electric expect to show the first production P.11 two-seat trainer based on the P.1 (and facetiously dubbed the "Lightning Conductor"). This has a widened front cockpit seating two side-by-side, but is otherwise similar to the P.1B.

Folland Gnat.—News of the Gnat is that the first two of the Finnish contract for 12 were delivered by air on July 30, while evaluation of the two ordered by Yugoslavia is continuing at an intensive rate. Six have been delivered to India, and ready to go are two sets of details and one set of major components, for assembly by Hindustan Aircraft, Ltd.

Trials with the Gnat in Aden, to assess its usefulness as a tactical ground-attack aircraft, have been completed, with 27 hours flown in seven days. This particular machine was one of the Indian order, made available to the M.o.S. for the trials, for which it was temporarily given the R.A.F. number XN122. It was flown out in a Beverley.

By the end of the year the flight development programme on the Gnat 1 will be complete, and the five M.o.S. Gnats will then become available for use in the flight testing of components for the Gnat Trainer and the supersonic Gnat 2. Prototypes of both these are expected to fly early in 1959. A Gnat 1 recently completed tropical trials in India, flying 33 hours in 45 flights in 21 days.

As part of the development of the Folland Type 1 seat, as fitted to the Gnat, four live ejections have recently been made over Salisbury Plain, from a Meteor.

Handley Page H.P.111.—A model of this military transport derived from the Victor B. Mk.2 was suspended above the Handley Page stand, but no new information was available beyond that published in THE AEROPLANE for August 22.

Handley Page H.P.113.—This interesting project was the subject of a small feature display but, again, no new information was forthcoming (see THE AEROPLANE for August 29). It is reliably reported that the H.P.113 is to be built to further research into laminar flow, and that its construction will be partially financed by interests outside the Handley Page Company itself.

Hawker Hunter.—Part of the Hawker Siddeley Group stand was devoted to a collection of Hunter models in the markings of the various countries to which this type has been or is being exported, and an impressive display of alternative underwing loads. The models covered the R.A.F. Mk. 6 fighter and Mk. 7 trainer; R.N. Mk. 8 trainer; Iraqi Mk. 6, Swedish Mk. 50, Danish Mk. 51, Peruvian Mk. 52, Indian Mk. 56 and Swiss Mk. 58 fighters; Indian Mk. 66 (trainer), Danish and Dutch trainers; and Belgian- and Dutch-built Hunters for NATO.

The display of stores, each of which was represented by a scale model, was divided to show the short-, medium- and long-range possibilities of the type. In the short-range configuration (i.e., with no underwing drop tanks) the following stores can be carried by the Hunter, distributed over four wing pylons:—

148 two-inch air-to-air rockets in four Microcell pods;
122 two-inch air-to-air rockets in four Microcell pods;
96 two-inch air-to-air rockets in four Microcell pods;
74 two-inch air-to-air rockets in two pods, and four practice bombs;
74 two-inch air-to-air rockets in two pods and two 1,000-lb. bombs;
74 two-inch air-to-air rockets in two pods and 24 three-inch R.P.;
74 two-inch air-to-air rockets in two pods and two 100-gal. Napalm tanks;
Two 100-gal. Napalm tanks and four practice bombs;
Two 100-gal. Napalm tanks and 24 three-inch R.P.;
Four 100-gal. Napalm tanks;
Two 100-gal. Napalm tanks and 12 three-inch R.P.;
Two 100-gal. Napalm tanks and two 1,000-lb. bombs;
36 three-inch R.P.;
24 three-inch R.P. and four practice bombs;
24 three-inch R.P. and two 1,000-lb. bombs.

In the medium-range rôle, the Hunter carries two standard Bristol plastic 100-gal. tanks, and can then carry on the other two pylons:—

Four practice bombs;
24 three-inch R.P.;
12 three-inch R.P.;
74 two-inch rockets;
Two 1,000-lb. bombs;
Two 100-gal. Napalm bombs.

For long-range sorties, four 100-gal. tanks can be carried, or two 230-gal. tanks, when the other loads can be as follow:—

Four practice bombs;
24 three-inch R.P.;
12 three-inch R.P.;
74 two-inch rockets;
Two 1,000-lb. bombs;
Two 100-gal. Napalm bombs;
Two 100-gal. tanks.

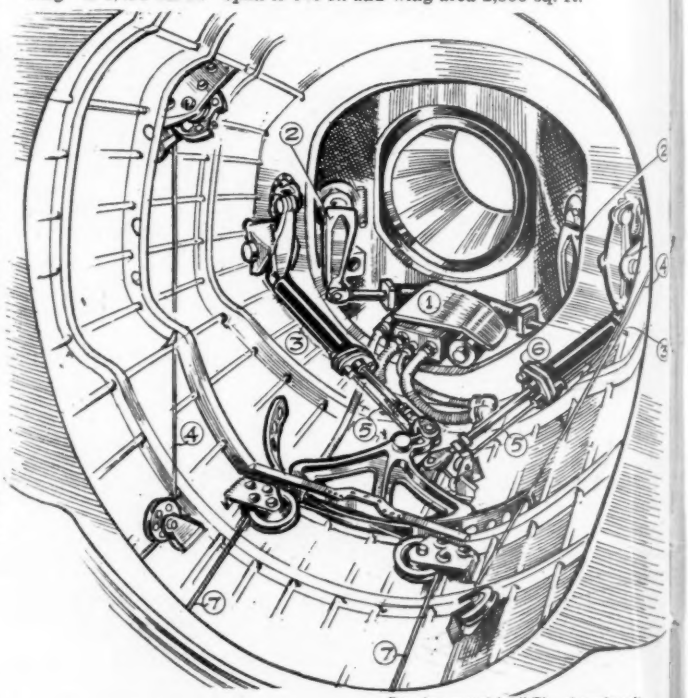
The list is continually being increased, and the Hunter's versatility in load-carrying has often been demonstrated. Both Firestreak and Fireflash missiles have been carried experimentally, and the aircraft will soon be cleared to operate with four 230-gal. tanks. Each of these Hawker-designed light-alloy tanks, when full, weighs a little over 2,000 lb. A Hunter has already taken-off, incidentally, at a gross weight of some 23,000 lb.

Scottish Aviation Twin Pioneer.—The first Twin Pioneer with Pratt & Whitney Wasp engines made its first flight at Prestwick at the beginning of Farnborough week, and is the first of five for Philippine Airlines. The Wasp installation is some 500 lb. heavier than the present Leonides Series II, this extra weight being compensated by the increased power.

The Wasp installation will be attractive in countries where the Pratt & Whitney engine has good spares backing, but it does not materially improve the performance of the Twin Pioneer. In the latter respect, Scottish Aviation are working on various refinements to the design—including modifications to the flaps—and a little later the newly announced long-stroke Leonides 530 appears to offer considerable promise in the Twin Pioneer. Alternative landing gear—floats and skis—is being designed.

Deliveries of the Twin Pioneer are at the rate of one a week and about half of the R.A.F. order for 32 have been completed. Four of the military aircraft have completed almost all their trials at Boscombe except paratroop-dropping. These tests, with supplies and troops, are about to begin.

Vickers V.C.10.—Although the model of the V.C.10—seen for the first time at an S.B.A.C. Display—was not quite up to date in its wing details, Vickers gave one or two additional facts about the largest turbojet transport yet designed in Britain. It will accommodate from 52 "luxury-class" passengers to 147-151 "thrift" class in a cabin 11 ft. wide at floor level. The freight capacity—mostly in an underfloor hold forward of the wing—is 1,450 cu. ft. Span is 140 ft. and wing area 2,800 sq. ft.



Drawing copyright "The Aeroplane"

On the Folland stand, a rear fuselage from a standard production Gnat showed the slab tailplane operating mechanism. Items keyed here are 1, Hobson electric/hydraulic tailplane operating motor; 2, tailplane operating lever; 3, spring feel unit; 4, rudder cables; 5, elevator locking cable; 6, lock jaws; 7, elevator cables. In case of power failure, the elevators are disengaged from the tailpane at the spring feel unit.

Farnborough Second Report . . . .

Aircraft Systems and Materials

NEW equipment on show at Farnborough last week reflected the development of Britain's latest military aircraft, such as the Blackburn NA.39, and gave a preview of the systems which have been or are likely to be adopted for the next generation of civil aircraft, beginning with the Vickers Vanguard and leading on to the V.C.10 and D.H.121.

Much of the new equipment on view was aimed at the designers of airliners; missiles aside, there was little evidence of work on equipment for new military projects. The reduction in military demand has meant that many equipment manufacturers are now seeking work outside the aircraft industry. The trend is exemplified by the manufacturers of servo-mechanisms and power controls, many of whom are now working on industrial process-control equipment. The Gloster technical-developments division, for example, at present devotes some 70% of its effort to aeronautical equipment, but plans to reduce this to 30% within two years.

The static exhibition showed current trends in aircraft systems. In electrics, AC systems are now the vogue; they have been thoroughly developed for the Mark 2 V-bombers and will probably be used on forthcoming jet transports. Pneumatics based on air tapped from jet engines play an important rôle; a new development is a powered control surface operated by engine-tapped compressed air. In the air-conditioning field fluid vapour-cycle cooling is under competitive development. Another system advance is the use of liquid-oxygen equipment; the R.A.F. has now standardized on a liquid-oxygen breathing system in the latest military aircraft. It is expected that liquid-oxygen systems, as opposed to gaseous ones, will be used in forthcoming airliners.

Details of some of the developments in aircraft systems, components and materials appear below.

Boulton Paul Pneumatic Power Control.—A new power-control under development by Boulton Paul Aircraft, Ltd., was exhibited for the first time. It was shown as an irreversible powered control-surface operated by low-pressure air, with all the mechanism buried within the control surface. No external jacks are needed. It is claimed that both the overall and the control-jack systems are lighter than those which depend on hydraulic power.

In this pneumatic power-control system, as well as in the company's latest hydraulic systems, use is made of a rotary control valve developed by Boulton Paul. This new rotary valve tends to avoid two of the difficulties experienced with piston-type valves—the relatively high "break-out" force necessary for initial movement of the valve and the dynamic loads caused by the flow of hydraulic fluid through the valve.

The negligible "break-out" torque of the rotary valve makes it particularly suitable for electrical operation. In consequence it is easier to introduce auto-pilots, autostabilization and variable gearing into the aircraft control system.

New Normalair Discharge Valve.—Six discharge valves of a new type will be used for the pressurization system of the Vickers Vanguard. Developed by Normalair, Ltd., each of these acts in a triple rôle as a discharge, safety and an inwards-relief valve.

In its discharge-valve rôle the valve responds to signals from a pressure controller, establishing cabin pressure at the correct value and maintaining it there. As a safety valve it prevents excessive cabin pressure building up. As an inwards-relief it limits the pressure differential to less than 0.5 p.s.i. if a rapid descent is necessary following engine or air-supply failure. The valve cannot fail in the fully-open position and, if the aircraft should be forced to ditch, it is closed by water pressure.

Use of six such valves in the Vanguard gives a reduction in the overall weight of the pressurization system; each valve weighs only 6.75 lb., despite its triple function. Reducing the number of valves of different types in the system simplifies maintenance and reduces the variety of spares required.

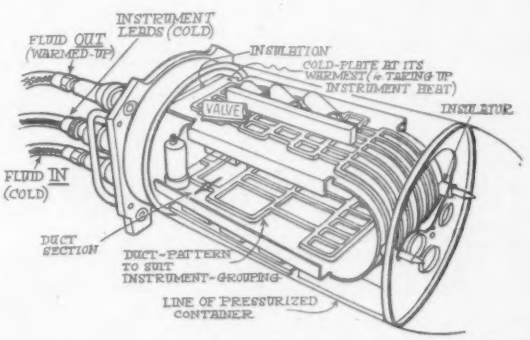
Short SC.1 Control System.—The control system for the SC.1 VTOL research aircraft was developed by Short Bros. and Harland, Ltd., to provide automatic stability during hovering and transition to and from forward flight.

The system has two triplicated groups which control respectively the pitch and roll movements of the aircraft through variable-thrust air jets at the wing tips and at the nose and tail. The air nozzles and control surfaces are operated by three-channel electro-hydraulic jacks.

The system is triplicated from the pilot's control to the output. The pilot's stick operates a triple-ganged potentiometer and the signals from this pass to three-channel gyro and amplifier units. These supply signals to the controls so that the aircraft is maintained stably in the attitude selected by the pilot.

As well as controlling air-jet thrust, the system also operates the aerodynamic surfaces. As a result control response becomes more and more rapid as forward speed is gained and finally the autostabilizer system and air jets are switched off and the normal aerodynamic controls are used by the pilot.

Liquid-cooling of Electronic Equipment.—Air cooling of electronic equipment is unsuitable for high-speed military aircraft, because ram air is heated and cannot be used economically to cool equipment. A liquid cooling system has been developed by the Royal Radar Establishment; it affords an efficient means of transporting waste heat from electronic equipment to a rejection heat-exchanger in which the aircraft's fuel could act as a heat sink.

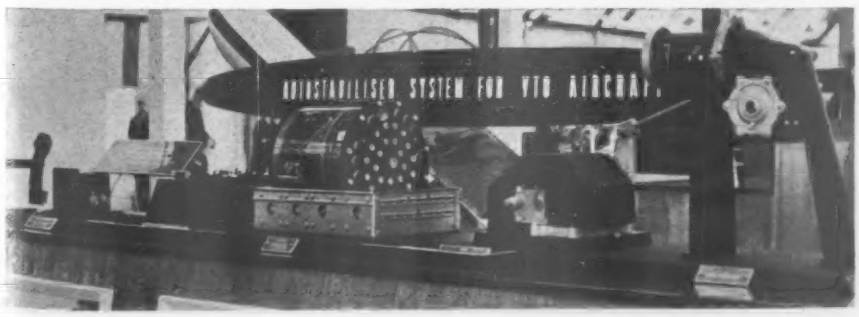


Drawing copyright "The Aeroplane"

This liquid cooling system for electronic equipment was demonstrated by the Royal Radar Establishment.

In the R.R.E. system the equipment chassis acts as the basic heat exchanger. The chassis is made of ducted aluminium sheet and housed in a pressure-tight container; heat transfer

(*Continued on page* 434)



The Short SC.1 has this triplicated autostabilizer system for air-jet control during hovering and transition to and from forward flight.

Photograph copyright "The Aeroplane"

Farnborough

Second Report . . . .

More Flying Pictures

Photographs copyright "The Aeroplane"

Above, the Bristol 192 tandem-rotor heli
Gazell

Below, the extreme agility o
We
an

Above, the impeccable formation-keeping throughout the performance of the 22 Hawker Hunter F.6s of No. 111 Squadron, R.A.F., was perhaps the most talked-about feature of the flying display.

Left, this picture of the D.H. Comet 3B—the prototype of the Mk. 4B for British European Airways—emphasizes the typical aspect of the short-span wing. The Comet 4, for British Overseas Airways Corporation, is seen below.

Left, making a really low-level
along the main runway at F
borough is the Hawker Hu
T.7 trainer, bearing bombs
fuel tanks.

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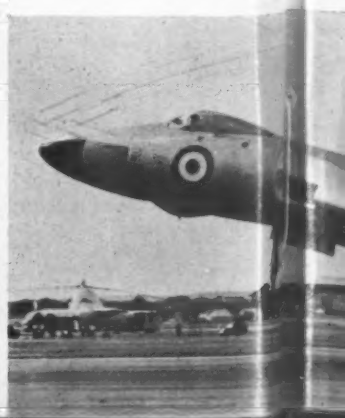

192 tandem-r helicopter was flown on both and on one of its Napier Gazelle shaft turbines.

e agility o Westland Westminster "utility" belied its great size and weight.

The underwing stores—D.H. Firestreak missiles and Microcell rocket pods—do not detract from the impression of speed in the picture of the D.H. Sea Vixen above.
Below, the stab of flame from the Napier Double Scorpion rocket motor of the Scorpion Canberra can be seen below the fuselage.

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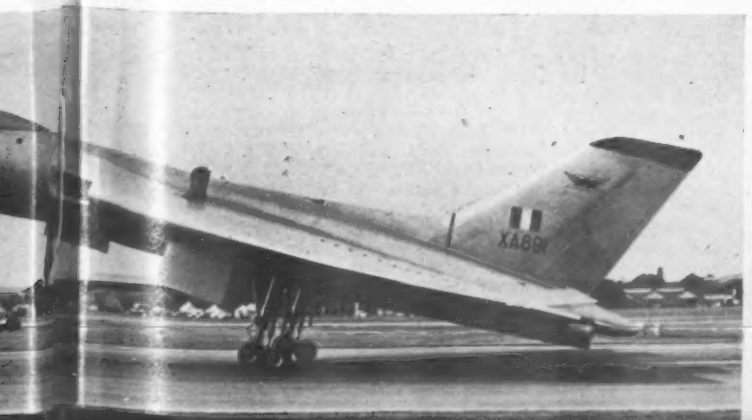
bombs

Below, a standard production Avro Vulcan B.1 V-bomber (four Bristol Olympus turbojets) about to become airborne.

Right, Gloster Javelin all-weather fighters from Fighter Command were an impressive component in the R.A.F.'s display.



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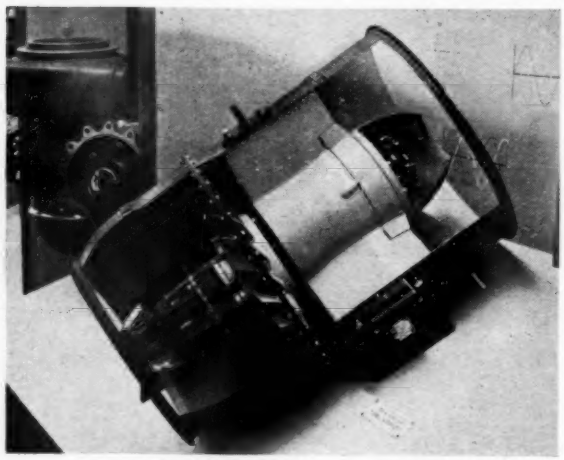
(*Continued from page* 431)

from the electronic components, which are soldered to the chassis, is both conductive and convective. The coolant is pumped round a closed circuit from the chassis to a rejection heat-exchanger and then via a reservoir back to the chassis. Accurate temperature control is possible, as the only variables are the temperature of the heat sink and the rate of coolant circulation.

The coolant used by the R.R.E. is Montosil E, a silicate ester made by Monsanto. It has a specific heat of 0.5, good corrosion properties, a high flash point and is non-toxic. It remains liquid from −80° to +200° C. Using this coolant, 1 watt of heat can be dissipated from each sq. in. of chassis area.

In the static display at Farnborough the R.R.E. showed



This Rotax ram-air turbo-alternator unit, seen in cutaway form, provides emergency AC power for a V-bomber.

electronic equipment sealed in a pressurized container, 7 in. in diameter and 10 in. long; liquid cooling was used to dissipate the 250 W. of heat produced by the equipment in the container.

It is estimated that liquid cooling would give a 30-40% weight saving compared with an air cooling system. All the aerodynamic and weight penalties of intakes, ducting and cooling drag would be eliminated.

Liquid-oxygen System.—The R.A.F. and the Royal Navy have standardized on liquid-oxygen breathing systems for the latest military aircraft. The airborne equipment to be used was shown for the first time by British Oxygen Aro Equipment, Ltd.

Considerable weight and space saving follow from the use of liquid-oxygen systems. At present British day fighters carry two 750-litre cylinders of gaseous oxygen at 2,000 p.s.i.; these weigh 35 lb. A single 3½-litre liquid-oxygen container provides twice the equivalent volume of oxygen at a weight of only 15 lb. and requires far less space. The larger the aircraft, the greater the weight saving; if emergency oxygen equipment were provided for a 150-seat jet transport, the use of liquid as opposed to gaseous oxygen would give a weight saving equivalent to two passengers.

In the airborne installation for military aircraft liquid oxygen is stored at less than 200 p.s.i. in a twin-walled spherical or near-spherical container, known as a converter. There is a vacuum between the walls to prevent the liquid from evaporating. This is essential because liquid oxygen boils at −183° C. at atmospheric pressure. An evaporating coil and a valve system allow the liquid to vaporize as and when required. The resulting gaseous oxygen passes to the aircrew masks on demand and at the required temperature. Liquid oxygen systems of this type are now being supplied for the Lightning, Sea Vixen, Scimitar, Gannet AEW.3 and Gnat Trainer.

Air-operated Hoist.—A small air-operated hoist has been developed by Joseph Lucas (Gas Turbine Equipment), Ltd.; it is particularly suitable for rescue work by gas-turbine helicopters. It weighs only 24½ lb. and has a vertical hook travel of 85 ft. For a typical rescue load of 220 lb. the lifting speed is 21 in./sec.

Only two services are needed for the installation; these are an air supply at 40 p.s.i. and up to 200° C. which has a maximum flow of 0.066 lb./sec. and a 24-V. power supply for the solenoids which select either the "up" or "down" valves in the air distributor. On a turbine helicopter the necessary air can be supplied by tapping the engine compressor; this is done on the Saunders-Roe P.531, which uses one of these hoists.

The hoist has a vane-type pneumatic motor which runs in either direction and has an immediate-stop device. An automatic cable-extraction device makes it unnecessary for the hook to be weighted, while a cable-tightening mechanism aids winding-in of the cable in no-load conditions. Cable movement is stopped automatically at the upper and lower limits and a remotely-controlled shear device allows the cable to be cut instantaneously in an emergency.

Beta Control on Vanguard Propellers.—The propellers for the Vickers Vanguard will be the first produced in Britain which use beta control. This term comes from American use of the Greek symbol beta for propeller blade-angle; beta control is in fact blade-angle control. It allows the pilot to select any blade-pitch angle between flight idle and full reverse pitch. Thus any value of positive or negative thrust between the propeller limits can be chosen by the pilot. The system is used for controlled reverse thrust and for ground manœuvring.

Beta control is not the only novel feature of the Vanguard propellers which have been developed by de Havilland Propellers, Ltd. This new propeller, 14 ft. 6 in. in diameter, has an impressive series of safety features. There are automatic hydraulic and mechanical pitch locks, both of which respond to loss of control pressure, as well as to overspeed in the case of the mechanical lock; mechanical and electro-hydraulic flight-idle stops; a hydraulic stop which follows the blades into the constant speeding zone: an automatic drag-limiting control sensitive to engine-shaft torque; two independent means of feathering.

Another new feature of the Vanguard propeller installation is synchrophasing, which reduces propeller noise level to a minimum. Not only are the propeller speeds synchronized; propeller position is also adjusted so that the blades of adjacent propellers are in a phase relationship which causes minimum-amplitude vibrations and thus the least noise. The correct phase relationship of the blades is maintained to within 8° in all normal operating conditions.

Micrograin Nickel Propeller Protection.—A special type of nickel sheathing has been developed by Metachemical Processes, Ltd., for protecting the leading edges of propellers and of air intakes. It is formed of micrograin nickel which is deposited electrolytically by plating hard nickel on a plastic-coated mandrel. The nickel so deposited has a very high resistance to impact and erosion.

Micrograin nickel for protecting the de-icing equipment at propeller leading edges varies in thickness from 0.025 in. at the leading edge to 0.006 in. at the trailing edges of the nickel sheath. Tests on Viscount propellers have shown that these nickel sheaths are resistant to damage and deformation by dust and stones at impact speeds up to 500 m.p.h. Stainless-steel sheaths of equal weight failed much more rapidly in similar tests.

Other tests have shown that the nickel sheaths are highly resistant to rain erosion; flight was simulated for 10 hours at 500 m.p.h. through a rainfall of one inch per hour and there was no apparent effect on the surface of a micrograin nickel sheath.

These sheaths are to be used on propellers produced by de Havilland Propellers, Ltd., and on the air intakes for the Rolls-Royce Tyne turboprop engine.

New Brazing Technique.—A nickel phosphorus alloy is used as the brazing medium in a new brazing technique developed by Electro-Hydraulics, Ltd. Successful joints have so far been made with stainless steel, copper, mild steel, nickel and K Monel; the process is likely to be suitable for most metals which have a melting point above the brazing temperature of 1,000° C. It is hoped to use this method for brazing titanium and zirconium.

Shear strength tests have been made with joints brazed by this technique; the results were good and in the case of copper-stainless-steel joints the copper sheared on failure, leaving the joint intact. These shear tests were made both at room temperature and at 500° C. Shear strength at 500° C. was only slightly lower than at room temperature, indicating that the brazing technique will be suitable for heat exchangers, radiators and other components which operate at temperatures up to 500° C.

No flux is used in this new process and thus joint soundness is improved because flux inclusions are absent. A further advantage is that the brazing medium is applied to the components as a plate which adheres to them. This simplifies jigging and makes it possible for complicated assemblies to be brazed.

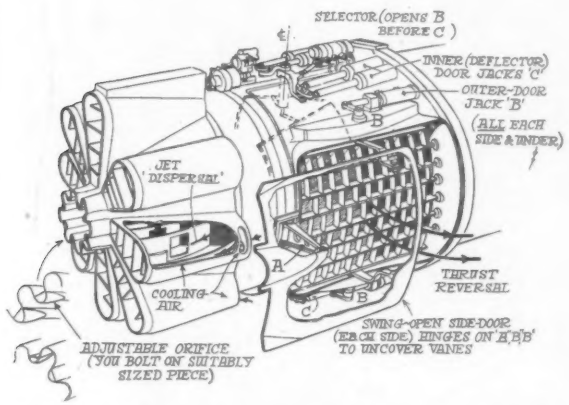
Farnborough Second Report . . . .

Engine Accessories and Equipment

Rotax Pneumatic Starters.—One of the newest of the Rotax range of pneumatic starters is for gas-turbine engines having moments of inertia up to 500 lb. ft.². Air is supplied to the starter inlet at 30 p.s.i. and 200° C. The air flow is 1.8 lb./sec. and cut-off speed is 2,500 r.p.m.

The time to reach this rotational speed against an inertia of 475 lb. ft.² is between 15 and 20 seconds. The unit attains a maximum power of 70 b.h.p. and weighs 20 lb. The largest starter in the range has an output of 150 b.h.p.

Special features of the design are self-contained lubrication; a mechanism for disengaging the starter from the engine; a shock-absorbing clutch; an overriding device for disengaging the starter from the engine; a centrifugal governor and automatic cut-off; non-toxic exhaust; and a high power/weight ratio.


SELECTOR (OPENS B BEFORE C)
INNER (DEFLECTOR) DOOR JACKS 'C'
OUTER-DOOR JACK 'B'
(ALL EACH SIDE & UNDER)
JET 'DISPERSAL'
COOLING AIR
THRUST REVERSAL
SWING-OPEN SIDE-DOOR (EACH SIDE) HINGES ON A'B'B' TO UNCOVER VANES
ADJUSTABLE ORIFICE (YOU BOLT ON SUITABLY SIZED PIECE)

CONWAY QUIETENER.—As fitted in pods to the Boeing 707-420, the Rolls-Royce Conway R.Co.10 by-pass turbojet has a corrugated nozzle noise-reducer and a side-venting thrust-reverser.

Drawings by J. H. Clark, A.R.Ae.S. copyright "The Aeroplane."

Corrosion Resistant Engine Alloy.—Effects of high gas temperatures used in some of the latest gas-turbine engines have resulted in the need for a new alloy with good resistance to corrosion, Nimonic 105. Such corrosion occurs in certain conditions of contamination by solid or molten sulphates associated with the process of combustion.

Fuels used in this temperature range are high-grade distillates, like aviation kerosene, which have very little corrosive effect at lower temperatures.

Henry Wiggin and Co., Ltd. have developed Nimonic 105 from the nickel-chromium-cobalt-molybdenum alloy Nimonic 100. It has greater creep-resistance at high operating temperatures, the minimum life before rupture being 50 hours at 7 tons/ sq. in. and 940°C. (1,213°K). The resistance to corrosion is, however, the most important feature and this has evidently been brought about mainly by increasing the chromium content.

Nimonic 105 is in production and has already been adopted fully by one British manufacturer. It is worth noting that Nimonic alloys have been used for 18 years. They have been specified for the turbine rotor blades of every British turbojet and turboprop engine, and in various forms (sheet, castings, forgings) have been used for a wide range of gas turbine components. Recent uses are for thrust-reversers and noise-reducers in such engines as the Rolls-Royce Avon R.A.29 turbojet and the civil versions of the Conway by-pass turbojet.

Airborne Auxiliary Power.—In its latest form the Rover airborne auxiliary power unit (A.P.U.) is a self-contained powerplant enclosed by a stainless steel nacelle which has detachable side-panels for maintenance access.

Rover Gas Turbines, Ltd., has developed the 1S/60 gas turbine engine as the prime mover and the A.P.U. has two main operational functions: to provide emergency electrical power for essential flight services should the main alternators fail; and to provide an independent supply of compressed air for main engine starting. It can also be used for ground servicing where both electrical power and low-pressure air are required independently.

The unit consists of a Rover 1S/60 gas turbine engine coupled to a Rotax 208-V. three-phase 400-c.p.s. alternator. The engine runs at 46,000 r.p.m. and drives the alternator, which provides 32 kW. at sea-level, through a two-stage helical reduction gear.

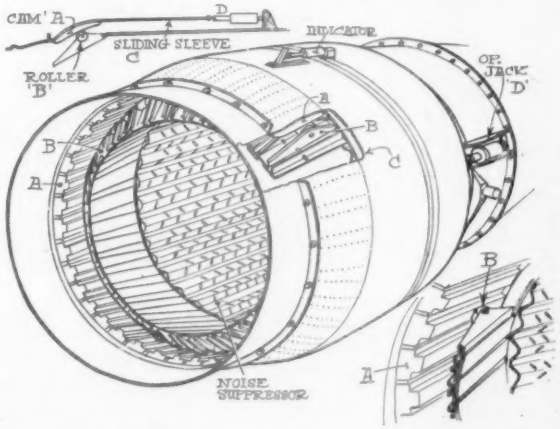
Provision is made for taking air, via an electrically operated bleed valve on the top panel of the unit, for starting aircraft main engines fitted with low-pressure air starters.

Engine intake air and cooling air are drawn in through an intake in the bottom panel of the nacelle. On the rear panel is the engine and cooling exhaust exit duct which can be moved in a full circle in 30° steps to suit different applications. Connections for instruments and electrical equipment are on the front panel.

There are two systems for engine starting, a 24-V. electrical starter for normal use and a cartridge starter for very rapid starting. The fuel system consists of supply and re-circulation pumps with a metering valve, an air/fuel ratio valve and two mechanical engine-speed governors—one for power operation and the other for air bleed. This second governor acts as a safety over-ride for the main governor. Maximum jet-pipe temperature is controlled by a mercury thermal element acting on the fuel flow to the burner.

Engine lubrication is by a gear-type pressure pump drawing its supply from the oil sump integral with the lower half of the compressor housing. For ease of starting well above sea-level, a three-element electric heater fitted to the sump maintains an oil temperature at 50°C.

Combustion chamber and exhaust system have heat-insulating blankets to maintain a reasonable temperature inside the nacelle. A mechanically driven fan provides cooling air for the alternator and oil cooler. In sea-level conditions at 15°C., air bleed is available at 44 p.s.i. and 549 cu. ft./min. This is reduced to 400 cu. ft./min. at 43 p.s.i. with a sea-level temperature of 45°C. and is increased to 686 cu. ft./min. at 48 p.s.i.



OLYMPUS ORIFICE.—The Bristol Olympus B.Ol.7 Mk. 201 is available with a Bristol-Solar afterburner. A feature of this nozzle is a corrugated and perforated anti-screech baffle to suppress noise in certain running conditions. Operated by an external shroud, the nozzle is gas-loaded to open and mechanically loaded to close.

when the temperature is reduced to −26°C. From sea-level up to 10,000 ft. the electrical output is 32 kW. This is reduced to 20 kW. at 20,000 ft. and 15 kW. at 30,000 ft. Weight of the Rover A.P.U. is 400 lb. Dimensions of the complete nacelle are 52.8 in. long, 37.6 in. high and 23.8 in. wide. It is being developed for operation at greater heights.

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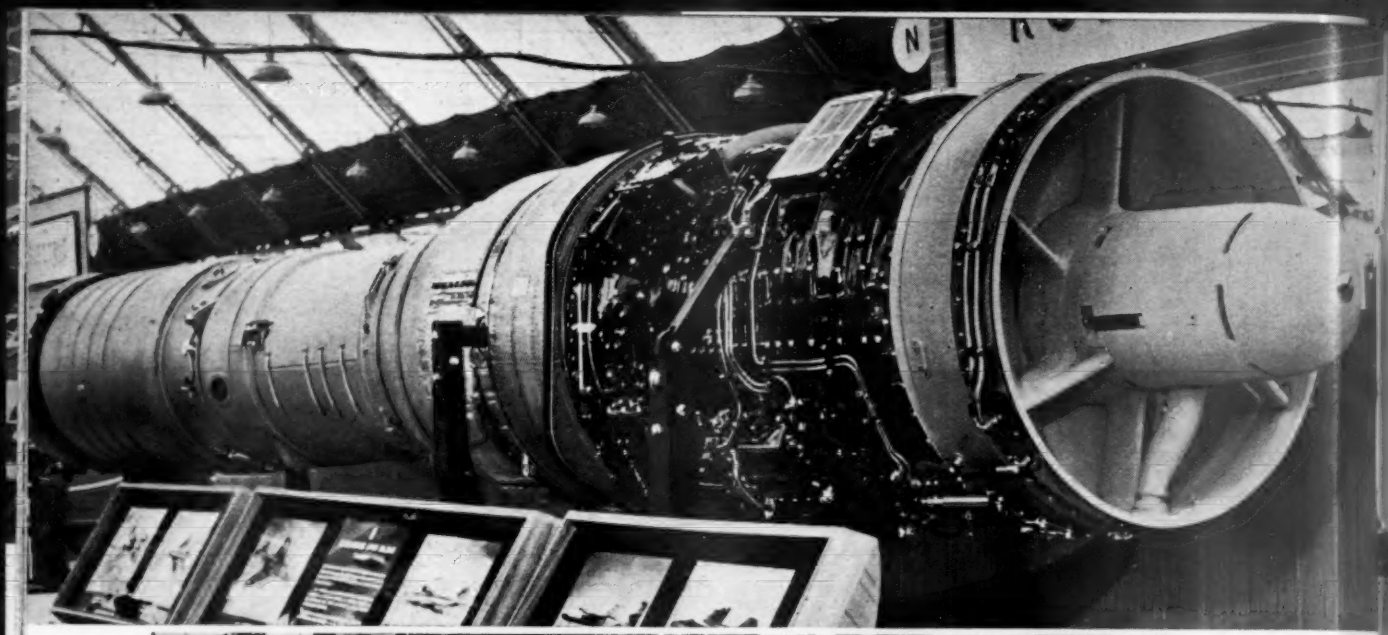
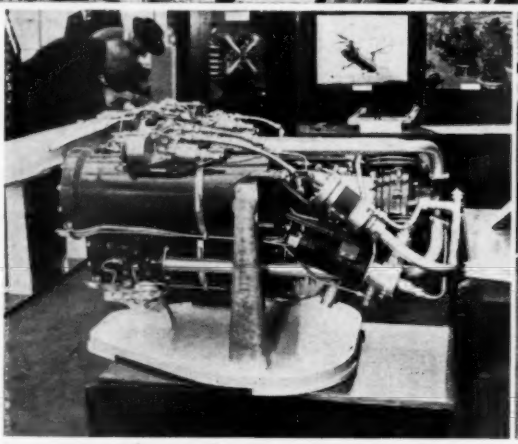
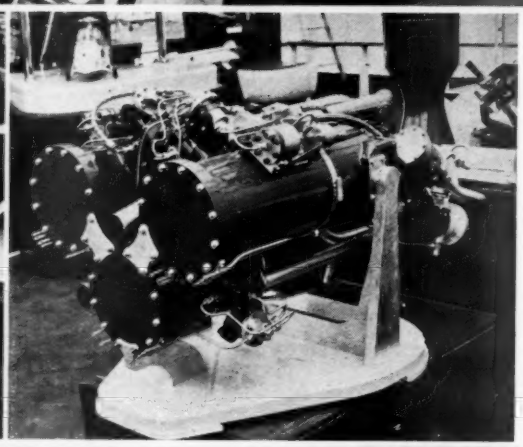
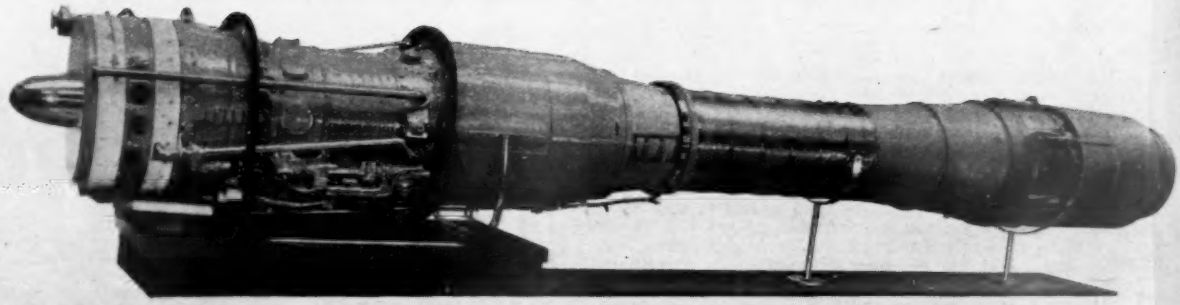


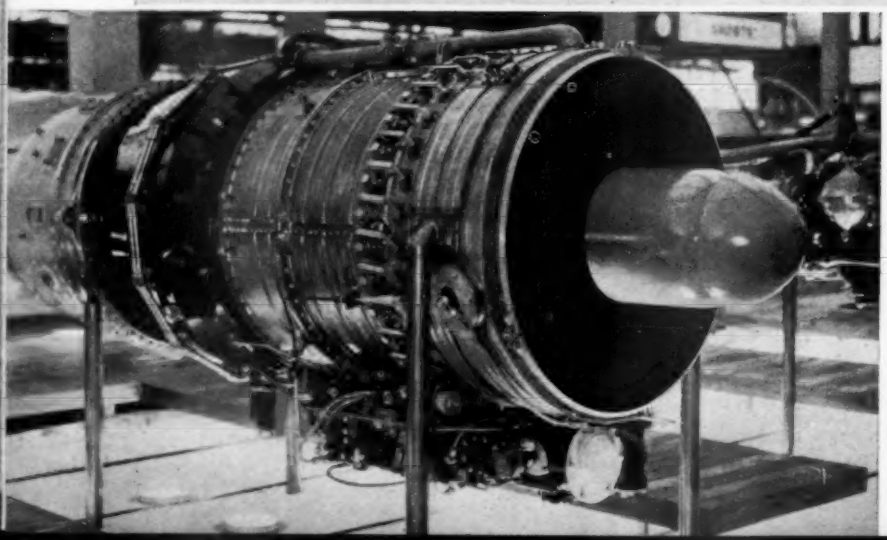




Above, the Rolls-Royce Avon R.A.24R, two of which power the Lightning, with fully variable petal-type afterburning nozzle.

Left, two views of the Napier Triple Scorpion N.Sc.T.1, shown for the first time.





Above, the Bristol Olympus B.Ol. 7 Mk. 201 fitted with Bristol-Solar afterburner.

Left, the D.H. Gyron Junior D.G.J.10, which has turbines and combustion systems of increased diameter for supersonic flight.

Farnborough

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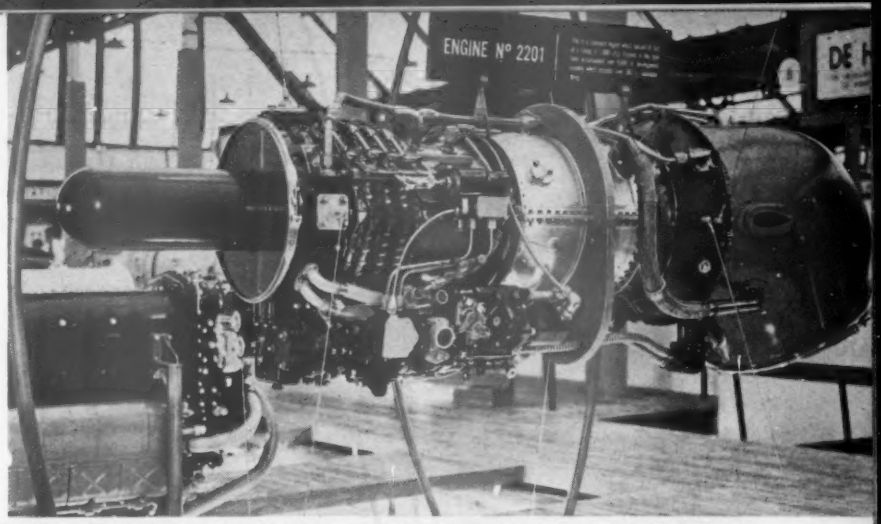
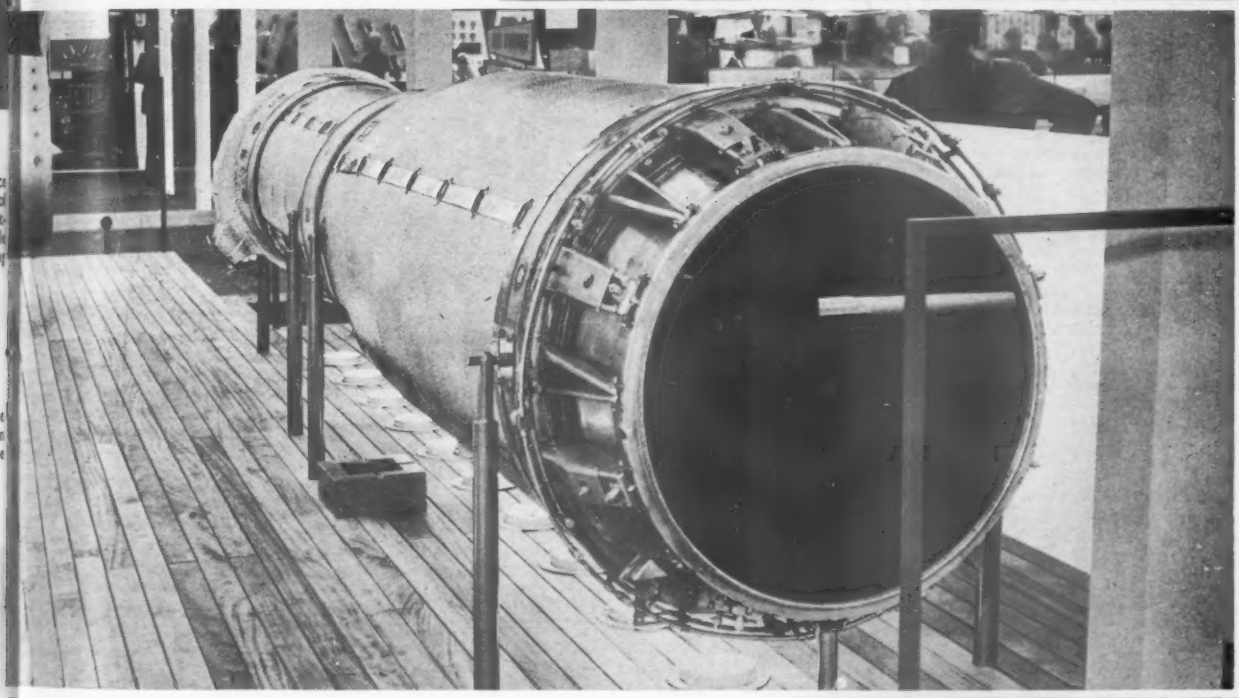
ENGINES ON VIEW



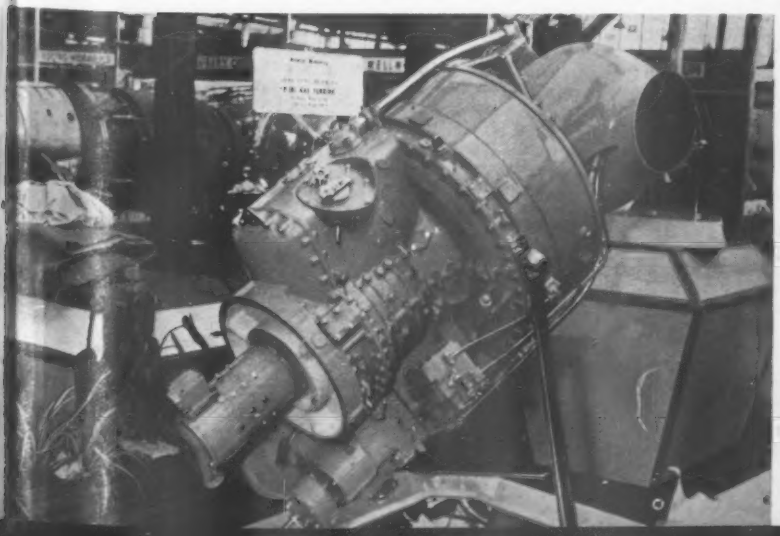
Right, the D.H. Gnome, 1,000-s.h.p. shaft turbine developed from the General Electric T58 and now built under licence.

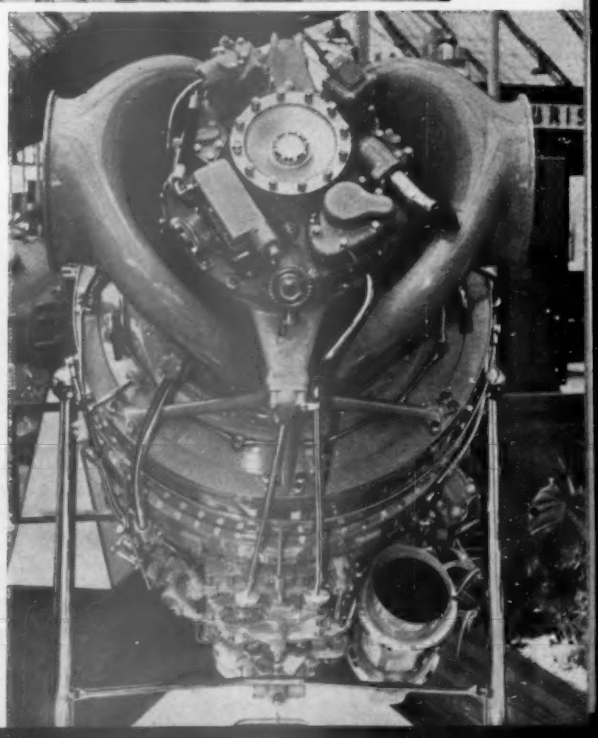
Photographs copyright "The Aeroplane"



Above, the D.H. Gyron D.Gy.2 of 29,000-lb. thrust with afterburning—a rear view.

Below and right, two views of the Armstrong Siddeley P.181, of 1,020-s.h.p., which made its first run early in Farnborough week.





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(*Continued from page* 435)

Testing of Ramjets.—Details of the simulated flight-testing of ramjets at the N.G.T.E., Pyestock, were given on the Ministry of Supply stand. Two ramjet engine test cells are in operation, both of 12 ft. diameter and with a length of about 25 ft. available for installation of a ramjet.

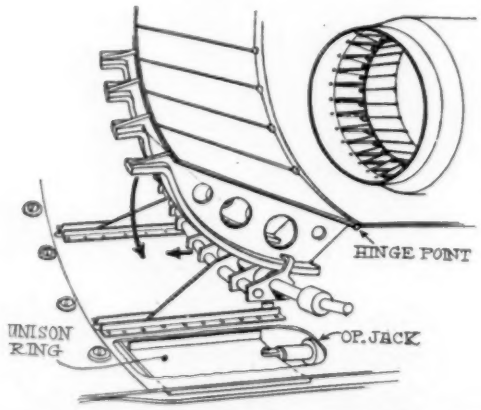
The cells are designed to use an available air supply which gives a pressure-ratio of up to 9 : 1 and a temperature of up to 600°K. For simulation of operation at great heights the same air supply is used to drive ejectors which produce suction to about 0.67 atmospheres.

One cell is used for testing with a supersonic air supply over a range of pressure, temperature and incidence at the inlet. At the front of the cell is a variable-incidence machine which holds the supersonic jet of air. Further downstream a bulkhead supports the spill-air diffuser gear which is mounted around the engine under test. Ramjets up to 24 in. diameter can be accommodated.

The other cell provides connected rig testing with all the air passing through the ramjet. The air supply is metered and supplied through a "floating" box which allows the thrust to be measured. Exhaust is vented to atmosphere or to the ejectors, and temperatures up to 2,000°K. can be accepted.

Test results are recorded photographically for study later, in order to save running time. Some data are supplied direct to a digital computer.

Ramjet intake design is critical and it is necessary under test for air to pass both outside and through the engine. Because of the very large quantities of air needed for ramjet testing, a considerable effort has been made to keep spillage to a minimum. The two cells provide all testing required prior to flight and enable some data to be obtained which would not be available in flight.



Drawing by J. H. Clark, A.R.Ae.S. copyright "The Aeroplane."

IROQUOIS AFTERBURNER.—The variable afterburner nozzle of the Orenda Iroquois is operated by a "unison ring" which changes the nozzle geometry by a system of cam tracks and rollers connected to the nozzle plates.

Engine Overspeed Indicator.—One of the first applications of transistors in airborne control equipment is the overspeed and rotation indicator developed by Pye, Ltd., for the Rolls-Royce Conway by-pass turbojet engine.

The new indicator is designed to detect and warn of engine overspeed. The only moving item is a small tacho-generator mounted on the engine and warning is normally given by a flashing light on the flight engineer's or pilots' panels.

It is fully transistorized and uses encapsulated or "potted" component bricks on printed circuit bases for increased reliability, reduction in weight and ease of manufacture.

Hobson Fuel Flow Proportioner.—Metering rotors of cycloidal form are used in the Type 333 and 334 fuel flow proportioners of H. M. Hobson, Ltd. Rotors are powered by a gear-type air motor to maintain fuel pressure to the engines in conditions of failure.

Pressure regulating valves control fuel inlet pressure into each cell. Since these are set to the same value as the outlet pressure, fuel "slip" is virtually eliminated and close-clearance running components are not required. The problem of air pumping from a damaged tank is also avoided.

Electric actuators are fitted to select by-pass or refuelling conditions and a speed governor is included as a safety control.

Hobson Afterburner Control.—Latest control system for an afterburner by H. M. Hobson, Ltd., gives a variable amount of control with improved efficiency of combustion. The system consists of a Type 320 turbo-pump, a Type 322 main flow control, a Type 323 primary flow control and a Type 324 ignition unit.

The turbo-pump incorporates a centrifugal pump driven directly by a single-stage turbine. Air intake to the turbine is controlled to provide a scheduled relationship between the amount of afterburning and the system fuel pressure. A speed governor is fitted to prevent overspeed of the turbo-pump assembly.

Fuel is supplied from the turbo-pump to a "split" control system. The primary flow control unit automatically maintains a fixed minimum amount of afterburning at stoichiometric conditions and the main flow control unit provides the control for the variable amount of afterburning. A fuel distributor valve and an over-ride sensing turbine expansion-ratio are also included in the flow control units.

The ignition unit is designed so that the duration of injection is scheduled with compression delivery pressure. Convenient adjustments permit the duration of injection and fuel flow to be varied over a wide range.

Measuring Mass Flow.—Direct measurement of the mass flow of fuel is attained by the new true mass flowmeter TDD. 160/1 of the Technical Developments Division of the Gloster Aircraft Co., Ltd. This flowmeter has been designed and developed to meet the needs for an instrument capable of the accurate measurement of the mass flow of fluids. It has a good application for aircraft because it permits accurate measurement of the weight of fuel in an aircraft, irrespective of ambient temperature.

It has previously been the usual practice to use flowmeters which gauge volume flow, a device which senses variations in relative density being calibrated in units of mass. The Gloster true mass flowmeter operates on a different principle. This is that angular momentum is added to the flow of fluid in proportion to the mass rate of flow, this momentum then being removed by a means of measurement in the form of a restrained turbine which extracts a torque proportional to the mass flow.

The flowmeter consists of two identical cylinders carrying radial vanes inside a shroud. The axes of the tubular passages thus formed are parallel with the axes of the cylinders and with the direction of fluid flow.

The upstream cylinder is driven at constant speed by an internally-housed motor while the downstream cylinder is restrained by a spring. The upstream cylinder can thus be regarded as an impeller and the downstream cylinder as a turbine. The impeller imparts a constant velocity to the fluid in a plane perpendicular to the flow.

This velocity is removed by the turbine which thereby acquires a torque loading. The turbine deflects until the torque is balanced by the restraining torque of the spring and this deflection is proportional to the rate of mass flow. It is measured and presented for inspection as a meter indication.

Spill Burner Fuel Systems.—Two types of fuel system, fairly obviously for the D.H. Gyron Junior D.G.J.1 and D.G.J.10, were exhibited by Dowty Fuel Systems, Ltd. A single circuit spill burner system for subsonic turbojets is evidently that of the subsonic D.G.J.1 engine while the other system is for the supersonic D.G.J.10.

Common to both is the use of spill burner nozzles which have no moving parts or small holes and whose performance is not affected by even severe degrees of erosion of the swirl chamber by foreign matter. The burners maintain a substantial pressure level at the high-altitude low-flow conditions of supersonic flight and obviate the risk of fuel boiling, which can occur in fuel systems where substantial quantities of heat energy are rejected to the fuel.

For a given circulatory flow, the quality of fuel atomization tends to improve with reduction in the rate of discharge from the nozzle. In this way, improved atomization is obtained with increasing height and the values of combustion are substantially maintained throughout the full altitude range.

The system for supersonic engines, such as the D.G.J.10, is capable of disposing of large quantities of heat rejected from aircraft ancillaries or the engine lubrication system. Spill burner characteristics are such that the fuel pressure remains relatively high and does not tend to fall off as with other nozzle types. This allows high temperatures to be maintained without the danger of vapour-locks forming or of the fuel boiling. It also ensures reliable distribution at extreme heights due to the insignificant effect of the burner ring hydraulic head.

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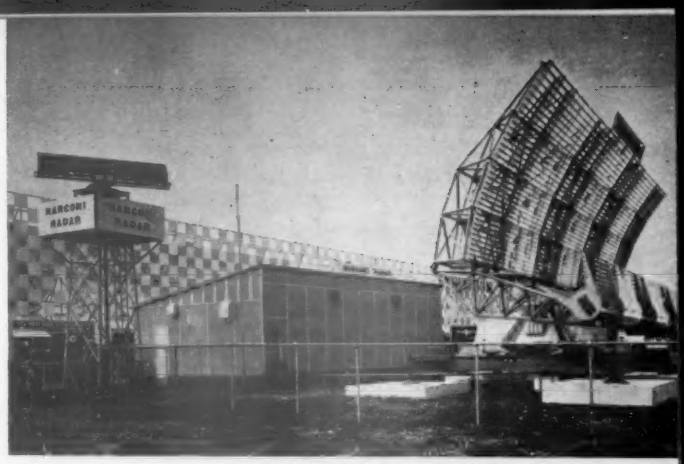
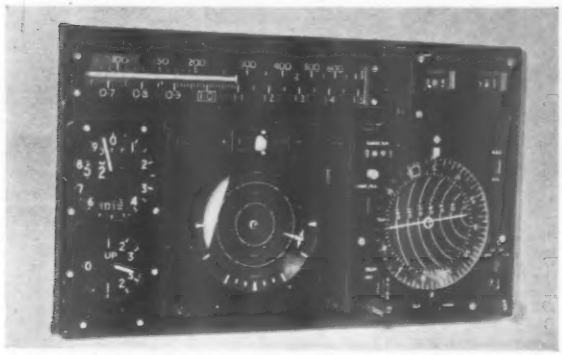
Navigation Aids and Instruments



ALTHOUGH there were many new items of equipment to be found among the navigation aids and instruments at Farnborough this year, probably the most important were those which showed something of the progress being made in the development of methods for improving the situation for the air traffic controller. Four manufacturers showed equipment or concepts which could lead to such improvements—three of them in the direct radar field and one in means of presentation of radar display information.

A.T.C. Radar Techniques.—The three radar demonstrations were provided by Marconi, Cossor and Decca, and the presentation system was by Kelvin Hughes. All four showed the way towards an improvement of the storing and presentation of radar-supplied information. Marconi, in particular, showed, on their outdoor site, an integrated system of data-handling display and progressing techniques which could, in fact, be applied to any existing small-scale A.T.C. set-up.

This Marconi demonstration involved three console displays,



Photograph copyright "The Aeroplane"

The revised display of the Kelvin Hughes Flight Data System includes dial presentation of altitude and vertical speed information (on the left). The navigation display (on the right) is set to the TACAN mode.

with progress boards, and the use of transferable marking symbols on the displays. The three display desks were those for the airways and approach controllers and a tracker. "Live" radar was used, with a large scanning aerial which dominated the outdoor site, and "raw" pictures were shown on SD 1000 series fixed coil displays giving ancillary information, and at the approach controller's and tracker's positions. The airway controller's display was synthetic, with video mapping for the area and the airways. The information on the progress board beside the airway controller's display was televised and repeated on similar boards beside the approach controller and the tracker.

It is the tracker's job to identify the various returns on his display, which covers a range of 100 miles, and to apply symbols on these returns; these symbols then follow the response on the display and are transferred to the airway controller's synthetic display, which thus shows only the symbols of known returns from aircraft which are under his control.

One of the advantages of the use of such a synthetic display for the controller is that the picture can be very much brighter than that of a "raw" display and can, therefore, be watched in ambient lighting conditions which permit the comfortable operation of a flight progress board. By means of a "future position indicator," the controller can determine the time of arrival of an aircraft at any given point and check this future position against that of any other aircraft under his control on the display. Direction-finding strobes can be applied either to the live or the synthetic displays in order to identify aircraft

When an aircraft starts to enter the area looked after by the approach controller, the airways controller uses an intertrace marker, such as a cross, which appears on the edge of the approach controller's display at the point where the aircraft is entering his area, which might cover a range of 25 miles. In his turn the approach controller accepts the new arrival by superimposing another symbol which is repeated on the airways controller's display as a proof of this acceptance.

A duplicate display from the Marconi radar equipment at Farnborough was used to demonstrate the Kelvin Hughes rapid processing photographic projector system on the outdoor site. This system photographs a radar display, develops the film and projects it as a black-and-white picture on a five-foot screen in the incredibly short time of six seconds. During the demonstration a new picture of the air traffic situation appeared on the screen at these six-second intervals—which was also the time taken for the radar scanner to complete one revolution.

The system has very obvious applications in civil air traffic control, though the initial development has been for military purposes and work was started as long ago as 1954. The equipment has been in quite large-scale production and 65 sets are now in use—35 of them in the U.S.A.

Both Cossor and Decca showed the technique for displaying information on a PPI; the Cossor demonstration was "live," on their outdoor site, while Decca showed the system with the aid of optical methods on their indoor stand. This technique means that all kinds of information can be generated and electronically displayed on the PPI to assist the controller in his work. In addition to identification symbols, such information can include runway extension lines, position cuts and, for military purposes, interception tracks. The Cossor demonstration included that for their transponder equipment.

Accurate Headings and Altitudes.—Apart from the first small indications of British work on inertial navigation—seen on the Sperry stand—new navigational-aid equipment on show included, importantly enough, new equipment for giving better heading information and developments leading to the provision of more accurate altitude information.

So far as the first of these developments is concerned, Kelvin Hughes showed their Mk. 1 Precision Directional Gyro, which offers a normal maximum drift rate of $\pm 3°$ per hour on any heading in typical flight conditions. This gyro is now in small-scale production and test results with the production equipment have been good. The gyro can be used either as such, or as an azimuth reference for a compass system.

The need for really reliable heading information is a particularly essential one if Doppler systems are to give the best results. New gyro techniques, such as that of the Sperry Rotorace and those which are (rather expensively) seen in the floated gyros used for inertial navigation systems are part of the story. The remainder may be seen in the north-seeking gyroscope systems which have been in use for some time in ships. Such a marine-type heading indicator was shown, perhaps

The early design o stable platform which was shown by Sperry, the fact of whose four-year work on inertial guidance systems was announced just before the show opened.

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significantly, on the S. G. Brown stand where, in addition to a demonstration Mk. 1 Master Reference Gyro, there was the case of the new Mk. 2 version. This, smaller and lighter than the earlier version, should be flying on test next year and some details are given on p. 422.

Following the appearance last year of the Smiths 100,000-ft. servo altimeter—with a new simplified presentation as well as a "motorized" mechanism to deal with the low-powered capsule responses at high altitudes—a new precision altimeter development was shown this year by Kelvin Hughes. This is radically different in operation from existing types of altimeter and makes use of a force balance unit, an example of which was seen on the same stand.

This new altimeter consists of two parts which are mechanically separate but electrically connected—these are the force balance unit/computer which measures the pressure and corrects the information provided, and a presentation unit. The output of the force balance unit is transformed mechanically by means of a cam from pressure to height. This information is then corrected for position error, using a computing circuit which is fed by transmissions from a Machmeter and which can also, if necessary, be used to correct errors due to angle-of-attack.

The corrected height output is then fed by synchro transmission to the presentation unit. This was shown on the stand in the now-familiar form of a single pointer and a two-figure

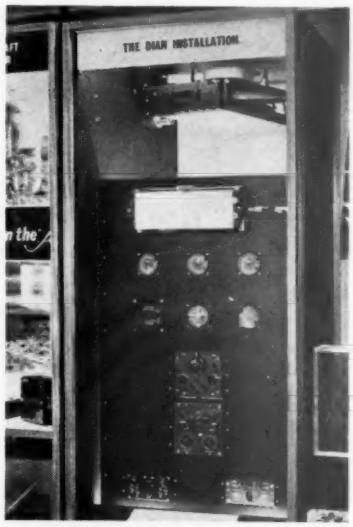
The Kelvin Hughes rapid processing photographic projector was demonstrated at Farnborough using a PPI display "piped" from the Marconi equipment on the same site. A picture of a radar display can be processed and projected so that controllers can watch, at six-second intervals, a continuous series of large screened pictures of a radar display.

Photograph copyright "The Aeroplane"

counter—the pointer revolving once per thousand feet and the counter giving the one or two digits of the height in thousands. Assuming a position error of less than ±10 ft., the total error of the altimeter will be less than ±40 ft. at 40,000 ft., or ±160 ft. at 70,000 ft.

Helicopter Autopilots.—Two types of helicopter autopilot are under development by Louis Newmark; one of these, for helicopters with power-operated controls, is now in production. The second is for smaller helicopters with manual controls; it provides pitch and roll stability and autopilot facilities.

The autopilot in production is for a military helicopter. As a stabilizer it gives the helicopter "hands off" stability characteristics similar to those of a stable fixed-wing aircraft, without affecting the pilot's control.



The DIAN Doppler installation on the Decca stand was a working model in that speed and heading information was being fed to the computer, with results appearing on the Doppler instruments and the Flight Log pictorial presentation.

Photograph copyright "The Aeroplane"

During the cruise, information on attitude is supplied to the system from the pilot's flight instruments; these signals will maintain the helicopter in any desired attitude and heading. By pressing a switch at the top of the cyclic stick the pilot can take over control; on releasing the switch the helicopter is locked on to its new attitude and heading.

During hovering automatic stability is provided and the pilot can also select "hover"—in which case the heading of the helicopter is maintained regardless of any changes in height, power, attitude, or position relative to the ground. Normal control is provided by the cyclic stick. When changes of heading are required the pilot selects "stabilize." Having taken up the new heading required, the autopilot will hold the aircraft on this heading if the pilot re-selects "hover."

Low-level Navigation.—The need to provide military pilots with the means of flying an accurate track at very low altitudes has led to the development of a Doppler-driven map-roller equipment by Kelvin Hughes. It consists of three units—the roller map, a remote transmitter and a course-keeping unit.

The map unit presents an illuminated map section (4½ in. by 5 in.) driven in either forward or reverse directions by Doppler equipment, or by a manually controlled variable-speed drive indicating ground speed on a dial. In case of Doppler failure, the system can be used by setting the calculated ground speed on this dial.

A position or datum bar covers the full width of the map aperture and carries a pointer or flag which gives cross-track displacement. When the cross-track pointer or flag reaches the edge of the map strip further departures from track are stored in a memory system. The remote transmitter unit contains a constant-speed motor driving two transmitters, one driving the map and the other the cross-track pointer. A course-keeping unit, which is essentially a compass repeater, is mounted near the map unit and gives indication up to 10° port or starboard of the correct heading.

In-flight briefing is provided by a tape recorder. The output of the recorder is connected to the intercommunication system so that briefing instructions are received in the earphones. The control of the briefing is automatically synchronized with the map movement by using spots of conducting paint applied to the surface of the map. These complete a switching circuit through a set of contacts to switch on the recorder for 10 seconds at a time.

The tracker's and approach controller's consoles in the Marconi air traffic control demonstration pavilion. On the left of each PPI can be seen the televised picture of the progress board at the airways controller's position. In addition to the three consoles the equipment included an SD 1000 display with a 15-in. tube developed for target indication and interception control and accommodating four seated operators.

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Survival in the Sky

MOST significant among the items of survival equipment displayed at Farnborough this year were the ejection seats for military aircraft, in the design of which Britain has a clear lead over the rest of the World.

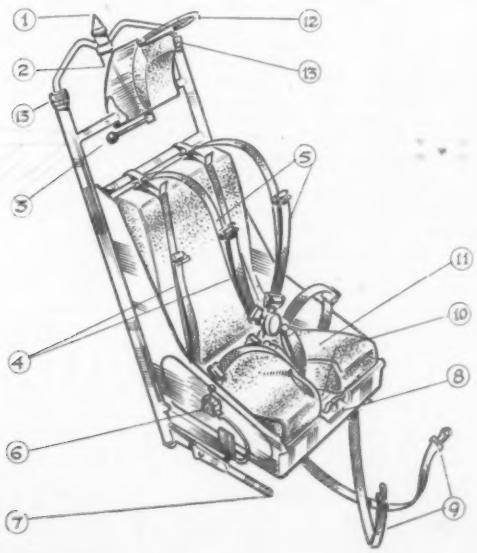
This superiority could not have been illustrated more graphically, albeit expensively, by an emergency ejection in full view of the massed crowd of technicians on the first day of the display, when a naval pilot was forced to abandon a Sea Hawk when only a few hundred feet from the ground. Although his Martin-Baker seat was of an early series, without interlinked canopy jettison, the ejection was completely successful, and the only injuries, of a minor nature, received by the pilot were through slipping his parachute just before landing to avoid drifting into the burning wreckage.

Current development is in the hands of two British companies.

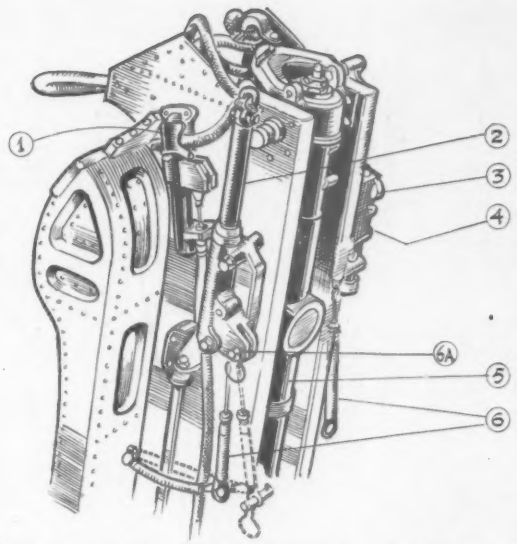
Folland Aircraft, Ltd.—This company originated a special lightweight automatic ejection seat in the first place for its Gnat light fighter. This seat has already been successfully used in an emergency ejection from a prototype Gnat, and was fitted to the two production aircraft taking part in the flying display. It has obvious additional applications for many other military types, and an example was installed in the Short SC.1 VTOL aircraft which was shown statically throughout the week.

On the Folland stand was a new seat design, the Mk. 4G, intended primarily for the Gnat Trainer, of which 14 examples have been ordered by the R.A.F. Developed from the standard Mk. 1 Folland seat, the Mk. 4 retains the same design layout originally adapted from the Saab seat, but has many detailed differences and improvements resulting in a much better performance.

The combined seat rails and ejection guns incorporate telescopic tubes to increase the initial velocity from 60 to 80 ft./sec., and there is a new combustion system for the single cartridge with its firing mechanism completely stowed in the headrest, which also houses the face blind. The central tube forming the combustion chamber is surmounted by a substantial probe to aid canopy penetration, and the swing breech which arms the seat is actuated by a nuisance lever protruding towards the pilot's head so that it must be rotated before it is possible to strap in.



Points of interest on the Folland Mk. 4G lightweight ejection seat, left, include 1. Canopy penetration probe. 2. Cartridge stowage and combustion chamber. 3. Swing breech safety lock. 4. Lift webs and vertical restraint straps. 5. Combined parachute and safety harness. 6. Release lever for harness. 7. Seat adjustment handle. 8. Emergency firing handle. 9. Leg restraint straps. 10. Survival equipment. 11. Seat cushion. 12. Face blind handle. 13. Colour coded gas release locks.



Details of the mechanism of the Martin-Baker Mk. A5 automatic ejection seat for the Chance Vought F9F-8T include 1. Guillotine for severing drogue connection for manual release. 2. Drogue gun. 3. Barostat housing. 4. G control and time release. 5. Main ejection gun. 6. Static connections for drogue gun and time release mechanisms. 6a. Safety and servicing positions of (6).

A new combined seat and parachute harness which has cleared all dynamic and physiological tests at R.A.E. is fitted to the Mk. 4G, and incorporates rear webbing straps for vertical restraint under negative *g* conditions in addition to the normal lap and shoulder straps. Another innovation is a single quick-disconnect point for main and emergency oxygen and R/T leads. A positive oxygen hook-up is ensured by connection with the R/T, i.e., no R/T before take-off means no oxygen. Leg restraint to prevent flailing at very high speeds is ensured by a suitable webbing system connected by snap-on hooks to straps round the calves or steel rings on an integral flying suit.

Primary actuation is by the face blind, although an emergency firing handle is provided on the front of the seat pan, in case excessive *g* prevents the arms from being raised sufficiently far. The seat is locked to the aircraft very positively by the gas-release mechanism at the top of the outer cylinders, slots automatically showing green or red to indicate safe or unlocked.

The Folland seat employs the principle of immediate separation after ejection (in 1 sec.), and stabilizing the pilot instead of the entire ejected mass. At the top of the flexible pack for the 18 ft. 6 in. shaped G.Q. parachute canopy is stowed the stabilizing system, which comprises two 3 ft. 6 in. parachutes connected side-by-side to an apron.

On ejection and separation, a static line on the seat arms a barometric release and releases the flap of the stabilizer compartment. The sleeve-stowed stabilizing 'chutes then deploy preventing the parachutist from tumbling or spinning and resulting in a mean descent speed of 100 ft./sec. until they are released by the barometric gear at about 10,000 ft., or on a time basis if ejecting below this height. The stabilizers then withdraw the main canopy, which is also sleeve-stowed to reduce opening shock, and the descent is checked to an acceptable 20 ft./sec.

Total ejected weight of the Mk. 4G seat, including parachutes, survival pack, oxygen, etc., is about 100 lb., and the bare weight about 45 lb. The peak ejection acceleration is about 20*g*, at a maximum rate change of about 250*g*/sec. It is soon to be dummy- and live-tested in this country from a Canberra and a Meteor. Intensive trials have recently been conducted with

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the Mk. 1 seat, fitted with the new combined harness, and four live descents have been made in recent weeks following the original earlier two ejections by Major Willans.

Arthur Harrison of G.Q. Parachutes ejected from a modified Meteor 7 from Boscombe Down on July 9 and 17 at 150 and 200 knots, and from the rear cabin of a Canberra B.2 on August 20, all at 5,000 ft., and Sgt. J. McLoughlin, R.A.F., did an ejection from the Canberra at 200 knots, also with the rear hatch removed, on August 21 from the same height. Both parachutists have flown to 40,000 ft. in the open cockpits of these aircraft to check airframe buffeting and exposure temperatures in preparation for a series of high-altitude test ejections. These will be done from a Canberra at Woomera in the near future, with stabilized free falls after ejection of dummies and the test parachutists from 40,000 to 5,000 ft.

Martin-Baker Aircraft, Ltd.—Two of its Mk. 5 range of ejection seats, which have been specially developed for the U.S. Navy, were exhibited by this company. The U.S.N. has always been interested in Martin-Baker seats, and following the successful demonstration at Patuxent of a runway ejection from an F9F-8T Cougar which had been modified at the company's Denham factory, decided to standardize the British equipment for all its future fighters. The Mk. A.5 seat for the Cougar was displayed alongside the G.5, which is also a lightweight automatic design for the M=1.8 Chance Vought F8U-3 Crusader.

In general, these seats conform to the standard Martin-Baker Mk. 4 design displayed last year at Farnborough, and incorporate the same multi-cartridge 80 ft./sec. telescopic ejection gun, the Duplex drogue system, actuated by an additional gun, plus all the other features which give them their unique capability for use at all airspeeds from 80 knots upwards and all heights from ground level and above.

To meet specific American crash requirements, however, the seat structure and harness have been strengthened to withstand an impact of 40*g*, which compares with the British specification of 25*g*, and this of course has slightly increased the weight. The G.5 is also different in having the standard manual seat-raising lever replaced by an electric motor and actuating system.

Above 10,000 ft. the Martin-Baker seats with their occupants are stabilized after ejection by two drogues, a small controller and a main stabilizer, which are extracted from their head-rest stowage by a piston fired from the drogue gun ½ sec. after leaving the aircraft. The drogues lay out the seat and occupant in a horizontal attitude, ensuring deceleration in line with the seat axis, until a normal vertical trajectory is achieved. They are then used to deploy the main parachute, which is stowed in a horseshoe-shaped back pack, thereby lifting the occupant clear of the seat, but the time release for separation is governed by both barostatic and *g* control.

Below 10,000 ft. the barostatic control allows separation and parachute deployment within 1½ sec. after ejection, which meets the critical runway case, but this time period is obviously unacceptable at very high speeds because of the resultant drastic deceleration on pilot and parachute. The *g* controller, however, measures the pull on the drogues during deployment, and above a certain figure interferes with the time release up to about 3 sec. until the seat has slowed sufficiently for safe parachute deployment.

Manual override is provided to jettison the drogues and release the harness and parachute, if ever required, and the G.5 seat showed a new and more foolproof system for this purpose. In this, the drogue lines are taken through a guillotine, and in the unlikely event of requiring manual separation, are severed by pulling the usual ripcord handle. This system, which is at present experimental, may be adopted for all Martin-Baker seats.

These are now being coupled with canopy-jettison equipment, the explosive jacks of which are fired by initial movement of the face blind. No pre-ejection action is therefore necessary, a 1-sec. delay occurring between departure of the canopy and the firing of the ejection gun. Provision is also made for the pilot to jettison the hood without ejecting from the aircraft. Although primarily fired by a face blind, all the seats now have an alternative handle on the front of the seat pan, for high *g* loadings.

The Crusader has an American system of canopy jettison, which is also coupled to the face blind, but an additional actuating handle was specified on the side of the seat head rest in case of difficulty. In the Cougar the seat is designed for ejection through the canopy. All the current production seats are fitted with the Martin-Baker personal equipment connector, which is designed to couple the anti-*g* suit, air ventilating suit, main oxygen and R/T connections between pilot and aircraft by a single action. On ejection, all services are automatically disconnected and sealed off, emergency oxygen being supplied via the main line. Webbing leg restrainers are also fitted as standard.—J.E.F.

Armament at Farnborough

APART from guided missiles, the most interesting development in aircraft armament displayed this year was the introduction of a 2-in. folded-fin air-to-air rocket fired from Microcell glass-fibre pods or hinged racks on R.A.F. and R.N. machines. It is some 14 years since the Germans first introduced into operational service the revolutionary 2-in. R4M folding-fin rocket for use against Allied bomber formations, and this was subsequently developed by the Americans into the widely used 2.75-in. Mighty Mouse rocket.

In Britain, experiments with similar rockets have been conducted over many years, and at the R.A.E. Jubilee in 1954, 60-mm. air-to-air rockets using both spin- and folding-fin stabilization were exhibited. In their final form, however, the British rockets appear to have reverted basically to the original German format, although differing in several respects.

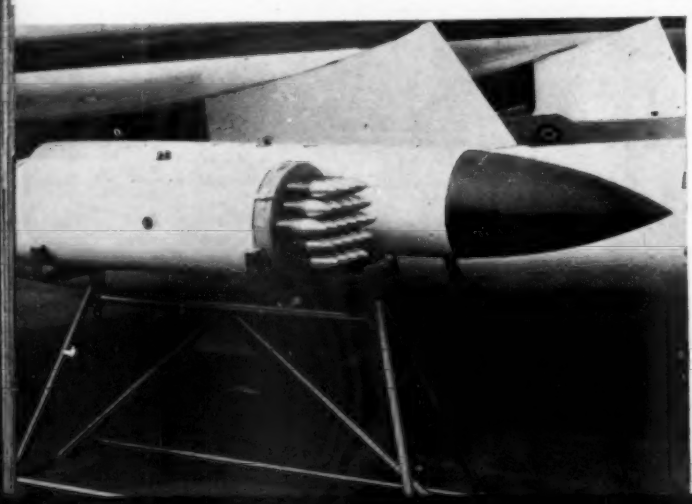
Although it is not possible, for security reasons, to discuss the new 2-in. No. 1 Mk. 2 rockets, several examples of their typical installation were displayed by Microcell at Farnborough. They are intended primarily as an anti-bomber weapon, to supplement guided missiles or cannon; but in their pod stowage, they may be carried by any aircraft fitted with a standard underwing bomb pylon, and have obvious additional applications for ground-attack duties.

Two pods have been developed, constructed from glass-fibre polyester resin, and were shown alongside the Sea Vixen, Javelin and Hunter. The larger type accommodates 37 2-in. rockets in a central matrix containing an integral support beam also of glass-fibre resin. A streamlined nose of frangible material shatters when struck by the first rocket salvo, and an open tail cone is provided to reduce drag and carry away the rocket exhaust. The electrical system is designed to carry the standard 26.5-V. American and British supply, and all connections and rippling devices are included in the launcher.

Successful air- and ground-firing trials have also been completed with the smaller pod, for 24 rockets, which was exhibited by Microcell last year. This pod is identical in construction and application with the larger type, but has advantages for certain duties. Flight-firing trials have shown a commendably small rocket dispersion from these launchers.

In the English Electric Lightning and D.H. Sea Vixen, the launchers form part of the normal aircraft contours until

(*Continued on page* 443)



The 24-rocket Microcell pod shown with and without its nose and tail fairings alongside a D.H. Sea Vixen.

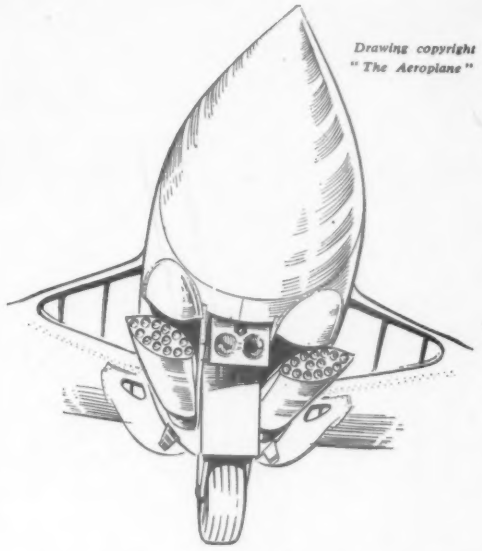
A 2-in. folding-fin aircraft rocket being loaded into one of the door launchers of the English Electric Lightning on the Microcell stand.

(*Continued from page* 442)

extended by hydraulic jacks. The Lightning launchers appear to be in the form of a pair of doors for the weapons bay, with a total capacity of 48 2-in. rockets. The glass-fibre matrix on each side is bonded and bolted to a pair of light-alloy cast hinges, and the plastic outer skin provides a contour and finish equal in all respects to the aircraft skin.

The launchers are pivoted near their outboard edges through bearings in the hinge castings, and the sequence of opening, firing and closing is automatic after the pilot presses the firing control. The electrical system is similar to those in the pods and with the rippling devices is contained within the launchers. These have been structurally tested to meet all conditions imposed on the Lightning, and firing trials have been successfully undertaken.

In the Sea Vixen the launchers are arranged slightly differently to form shallow fairings on each side of the nosewheel well. The rear part of the two fairings hinges down from the aft end, exposing the front of each 14-tube glass-fibre matrix for the firing position. A front blast plate of similar material is attached to the forward face to withstand the rocket efflux. As in the Lightning, operation is entirely automatic on pressing the firing button. Electrical connections are mounted on the launchers; fuse, resistance and ripple firing units are contained in the aircraft. Firing trials have been successfully undertaken.



Drawing copyright "The Aeroplane"

A sketch of the Microcell 14-tube launchers extended to the firing position beneath a D.H. Sea Vixen.

Airfield Ground Equipment

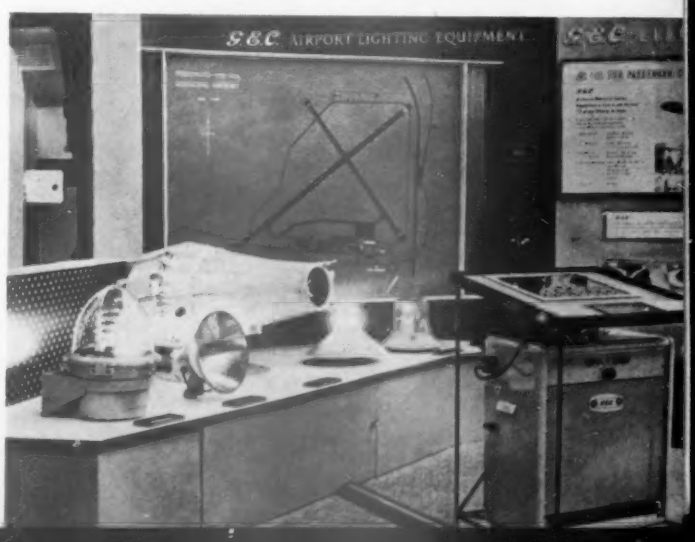
THIS year the theme on a large majority of the stands displaying aircraft servicing and maintenance equipment in the indoor exhibition and outdoor display site has been the progress to reduce aircraft turn-round times coupled with improved servicing facilities. Developments in both hydrant and mobile refuelling equipment were evident in a number of exhibits and new ranges of aircraft electrical servicing trolleys were also displayed.

Pre-flight servicing units such as engine and aircraft heaters, and de-icing equipment on show illustrated improvements in these fields and such items as aircraft jacks demonstrated the progress being made in all spheres of servicing. In the aircrew ground training field, development was seen on the Ministry of Supply stand where the R.A.E. pilot view simulator was demonstrated.

Fuel Flow Control.—The theme of the display by Simmonds Aerocessories was "handling aviation fuels" and the company's exhibits covered a number of fuel control units. Among these were two new items—an excess flow stop valve and a flow-rate controller.

The Simmonds excess flow stop valve is for insertion in a liquid stream when it is required that in the event of the flow-rate exceeding a predetermined value of gallons per minute, the liquid stream should be stopped. After the stream has been stopped by the valve closing, the flow can be restarted only by manual resetting of the valve. The valve can be manually reset against a fuel stream of at least 160 p.s.i.

Second of the two exhibits—the flow-rate controller—is used in a fuel stream where it is necessary to limit the flow-rate to a predetermined number of gallons per minute. The controller is basically a plug valve, the progressive opening of which is governed by the differential pressure developed across an orifice placed in the fuel stream; this latter pressure is a function of the flow-rate. In addition to its use as a flow-rate controller, this valve may also be attached to a water separator when



The airfield lighting exhibit which was on The General Electric stand. The control panel in the foreground is for the company's DC multiplex equipment which can be used in conjunction with various types of lights employed in airfield lighting.

Photographs copyright "The Aeroplane"

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hydrocarbon fuels are being handled. In this application the valve acts as a fuel shut-off valve when the water level in the separator reaches an excessive height.

Airfield Lighting.—Among the features on The General Electric stand was an illuminated map of Southend Airport, where the company has installed its new system of high-intensity runway lighting. Using a control panel in association with the G.E.C. DC multiplex equipment, the exhibit showed each of the various types of airfield lights in use and its installation position on an airfield. These units included high- and low-intensity elevated runway lights and taxiway, approach and neon obstruction lights.

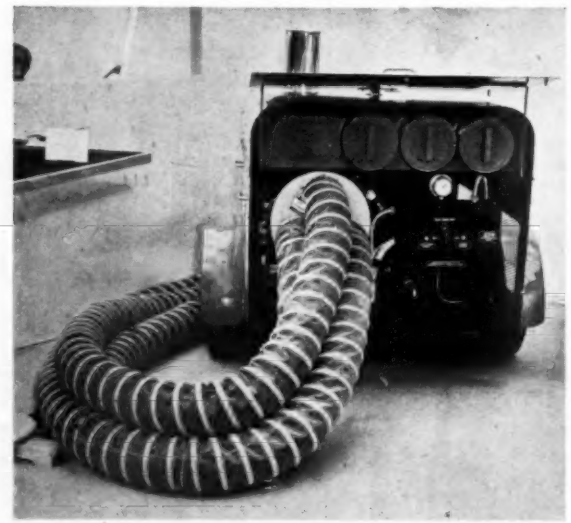
The most interesting feature of the display was the DC multiplex indicating equipment. The function of this unit is to monitor DC signals which indicate the operating state of the system at remote locations. Information from 12 lighting circuits can be relayed to the control along a single pair of wires. The signals or indications can be transmitted simultaneously along the two wires up to distances of 300 miles, depending upon the type of line used.

By this method old installations can be used to service a greater number of lighting points on an airfield, without the necessity of laying new wires.

Emergency Supply.—To maintain essential airfield electrical services in the event of failure of the mains supply, Blackburn and General Aircraft displayed a Blackburn-Houchin alternator set. Powered by the Blackburn Turmo 602 gas turbine, which has a continuous rating of 325 s.h.p., the alternator will supply an output of up to 200 kW. at 400-V 50 c.p.s.

In the side of the set three small lamps are fitted which are supplied with current from the three-phase mains supply, one lamp for each phase. A mains failure extinguishes the lamps, and immediately the engine starting sequence is put into operation. After the engine has started and accelerated to a power sufficient to bring the alternator up to its governed speed, the lamps are re-lit to show that the power failure has been made good.

When the mains supply is restored the alternator set is automatically shut down.



The latest unit in the range of Dragonair oil-fired mobile air heating trailers is this type DQLA 100. It has an output of 100,000 B.Th.U./hr. and can pre-warm 50-seat transports in approximately 30 min.

Dragonair Heater.—A recent addition to the range of oil fired mobile air heating units produced by Dragonair, Ltd., for aircraft engine and cabin pre-flight warming is the DQLA type of heater. Completely self-contained and fitted with a coupling for towing by tractor, this type of unit will pre-warm transports of up to 50-passenger size in approximately 30 min. Single or multiple hoses can be attached to the heater for either simultaneous or separate cabin and engine warming.

Two sizes of equipment are covered by this type specification to provide different outputs. The heater at the show—the DQLA 100—has an output of 100,000 B.Th.U./hr. with an overall thermal efficiency of not less than 85%. At rated output the heated air temperature rise produced by the unit is 110° F. and the ventilating air flow is 800 cu.ft./min.

The larger unit, type DQLA 250, is designed to provide an output of 250,000 B.Th.U./hr. with the same overall thermal efficiency. Its ventilating air flow is 2,000 cu.ft./min. and it has a heated air temperature rise of 110° F.

Foamite Fire Tenders.—Built on the new Austin Gipsy four-by-four chassis, two new types of "first aid" fire tenders have been designed by Foamite, Ltd. One is a water pump or foam tender and the other is a dry chemical powder tender. Both tenders are powered by a 62-b.h.p. petrol engine and can carry a driver and fire crew of two in the cabin.

The water pump/foam tender has a Coventry Climax A.C.P. front mounted pump which has an output at 10 ft. lift of 510 g.p.m. at 100 p.s.i. The liquid tank, mounted in the wall of the vehicle behind the cabin, has a capacity of 40 gallons. The dry chemical powder tender is equipped with two 200-lb. pressure containers for Foamite chemical, with two 10-lb. CO_2 cylinders for pressurizing. The system is complete with pre-set reducing valves for metering the CO_2 supply, pressure gauges, and two 60-ft. lengths of $\frac{3}{4}$-in. high-pressure hose terminating in two pistol grip flat fan discharge nozzles with swivel couplings.

Standard equipment supplied with both types of tender includes two 8-ft. lengths of 4-in. armoured suction hose with round thread couplings; 50-ft. lengths of canvas fire hose, and coupling units.

Photographs copyright "The Aeroplane"

On the Foamite outdoor display stand was this dry chemical powder fire tender. Built on an Austin Gipsy chassis, it is fitted with two 200-lb. pressure containers, two 10-lb. CO_2 cylinders and hand fire extinguishers.

Skyhi Jacks.—A number of new aircraft jacks were to be seen on the Skyhi stand. These have been developed for both heavy and light aircraft and cover a number of undercarriage configurations.

The first was a heavy-duty tripod wing jack, which can be either individually powered or operated as a set of jacks from a central console. This type has been developed for the larger aircraft and can have either electrical or pneumatic operation, with hand operation as a standby. Spring loaded caster wheels are fitted for transportation.

Twin-wheel-change double-ram jacks connected by high-pressure hose to a separate pump unit were also on show. This equipment has been developed for use with heavy transports and is employed on a bogey undercarriage which is fitted with stub axles; the closed height is 11 in. and the hydraulic lift is 11.25 in. The model at Farnborough could deal with an aircraft of 180,000 lb. all-up weight but higher capacities can be developed.

A 30-ton wheel-change double-ram jack for large aircraft where there is limited space available between the wheels was also on the Skyhi stand. This unit has a closed height of 12.25 in. with a hydraulic lift of 12 in. For use with lighter aircraft with low ground clearance, such as helicopters and lightweight fighters, there was a 3-ton tripod jack. Fitted with spring loaded caster wheels for transportation, this latter jack has a closed height of 16 in. and a double ram construction giving an hydraulic lift of 23 in.

Pilot View Simulator.—On the Ministry of Supply stand the R.A.E. exhibited a pilot view simulator which although

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(*Continued from page* 444)

originally constructed for research into the visual basis of flight, can be directly applied for training purposes. The equipment shows in perspective the pilot's forward view in visual flight which can be used in conjunction with the various types of "blind" aircraft flight simulators to provide a method of completing instrument approach procedures to the point of touch-down.

For the exhibit TV monitors were used to present the pilot's view, but for actual applications a large projection screen is normally employed. Entirely artificial, the picture is generated by an optical and electro-mechanical system and it is controlled by means of the control column, so that changes of altitude and of heading can be effected.

The principal units of the equipment are a computer, projection unit, screen and viewing unit. The computer is designed to operate in conjunction with the aircraft flight simulator from which it can accept computed values of attitude, heading, speed and altitude. In the projection unit the ground pattern, provided by mosaic, synthetic airstrip or lighting pattern, is supported in a horizontal plane by a carriage with independent movements for north-south and east-west displacements, and a third rotational movement for changes in heading. The ground pattern is illuminated by a B.T.H. Xenon arc lantern and projected forward in a horizontal direction by an optical system.

Consisting of two rectangular areas, each approximately 4 ft. square, at right angles to each other, the screen is designed so that one part receives the ground picture and the other is used for the sky projection, for which an auxiliary projector is used. The optical axes of projection are about 4 ft. above floor level and the rotational axis of the ground picture is arranged to pass through the viewing position. The viewing unit is made up of a Pye industrial television camera and is mounted in a bearing which permits rapid response in roll. The assembly is mounted on a second bearing for pitch motion, with the pitch axis passing through the node of the camera.

It is the function of the projection unit to produce the moving picture of the ground and to move it in such a way as always to cause it to approach the viewing position from the required heading. This picture is formed on the right-angled screen and the viewing unit, situated to one side of the screen, is used to record what is seen in perspective by looking across the picture. The computer is employed to calculate what should be the effect of any movement of the control column and to produce the requisite movements and changes in the final picture.

A portable test trolley for the ground testing of pressurized aircraft. Manufactured by Normalair, Ltd., it is designed to test individual components of the complete pressurization system.

The sky presentation in the synthetic picture may be darkened or varied according to any desired conditions, and may be entirely suppressed for night flight simulation. Also, the range of visibility can be varied, which is particularly useful for changing the simulated approach conditions.

Electrical Servicing.—Two integrated AC/DC aircraft electrical servicing trolleys were exhibited by Houchin, Ltd., of London. Providing 400 c.p.s. AC supply, these sets are among the latest electrical airfield units designed to match up with the requirements of the new AC aircraft systems.

One is the Houchin HY-CY trolley which comprises a Ford Zephyr industrial engine with a directly coupled 15-kVA. high-frequency alternator. Mounted in line with the alternator is a 3-kW. DC generator and an exciter. The engine, alternator and generator, together with the control gear, are mounted on a four-wheeled sprung chassis, and enclosed in a steel canopy.

Outputs of the trolley are AC 43 amp. at 200 V., 400 c.p.s. at 0.8 power factor continuous; DC 105 amp. continuous at 28.5 V.; and DC 350 amp. intermittent at 28.5 V. The equipment is protected against overload, over- and under-voltage, reverse current and phase failure conditions.

The second trolley is for servicing aircraft with 112 V. DC, 28 V. DC, or 200 V. AC, 400 c.p.s. electrical systems. Its outputs are 112 V. DC, 100 kW. continuous; 28 V. DC, 20 kW. continuous; and 200 V. AC, 400 c.p.s., 3 phase, 6 kVA. continuous.

This latter trolley consists of a Dorman 6 K.U.F. industrial Diesel with a direct flexibly coupled 112-V. DC generator to which is coupled an AC exciter. The engine, generator and exciter assembly together with the engine control panel are mounted on a Carrimore trailer with a second supply unit. This comprises a 112-V. DC motor to which is directly coupled at the front end a 28-V. DC generator, and at the rear end a 200-V. alternator. Complete control of the electrical equipment and the outputs are undertaken in a separately mounted console on the trolley.

The whole assembly is enclosed in a weather-proof canopy which is designed to accommodate the operator and to allow servicing to be undertaken from within.

The motorized overwing hydrant dispenser exhibited by Rellumit (London), Ltd. The plate on the top of the ladder is a proximity detector which locks the brakes and clutch if the dispenser is driven closer than a predetermined distance to the wing of the aircraft.

Photographs copyright "The Aeroplane"

Personalities Among The Aeroplanes

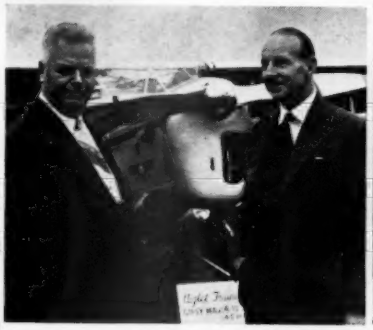
Above, in the President's enclosure Mr. Aubrey Burke, right, with Mr. Cyril Uwins (past president) and Mr. E. C. Bowyer.

Below, left, Admiral Sir Guy Grantham, C. in C. Portsmouth (right) with Cdre. L. V. Robins, Chief of Naval Staff, Royal Belgian Navy.

Below right, General P. Bailly, French Armée de L'Air and General M. Vallin.

Above, Earl Mountbatten with ex-King Leopold.

Left, Mr. Ed. H. Heinemann, chief engineer El Segundo Division of Douglas Aircraft, and Mr. M. E. Oliveau.



Above, Mr. Tony Milward and Mr. B. S. Shenstone of B.E.A. with (right) Mr. Robert Cummings, president, New York Airways.

Above, MM. Salvador, Montarnal, Lesieux, Legros and, extreme right, Max Hymans, chairman Air France.

Above, Maj. Gen. Marvin Demler, U.S.A.F., Brig. Gen. H. Franklin Gregory, U.S.A.F., Lt. Gen. J. H. Doolittle, Maj. Gen. John Sessums, U.S.A.F.

Above, Col. O. Seeve, C.A.S. Finnish Air Force, Capt. P. K. Killinen, Finnish Air Attaché, Mr. W. E. W. Petter, Sq. Ldr. A. Hubitata, Wg. Cdr. R. Turkki, Major U. Kettinen, Asst. Air Attaché.

Left, Wg. Cdr. R. I. M. Bowen, R.A.F., Mr. Frank Murphy, Lt. Col. R. Arague, Snr. Julio Pocattera, Major A. Vivas, Major G. Marquez, Mr. A. P. Wills. The three officers are members of the Venezuelan Air Force.

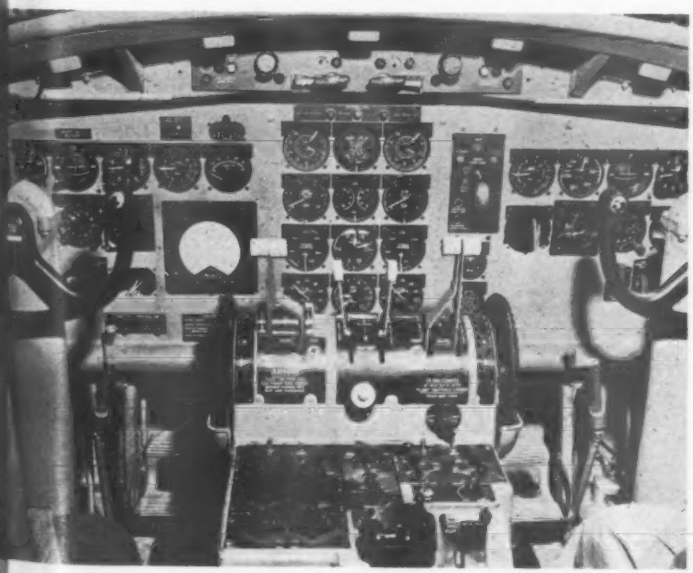
New World Photo-News

Pictures from Howard Levy

JET EXECUTIVES.—Above, seen at Malton, Ontario, are four of 26 surplus D.H. Vampires of the R.C.A.F. destined for the U.S. They have been bought by Fliteways, of West Bend, Wisconsin, along with spares ranging from complete engines to wing panel assemblies. The aircraft are airworthy and complete except for R.C.A.F. radio and armament. Thirteen other Vampires have already been sold in the U.S. as private "hacks." They cost about $27,500 each.

SAFETY FIRST.—Above, a Sikorsky S-58 of Humble Oil fitted with flotation gear and used for off-shore operations.

OLD TIMER.—This Fokker Dr.I Triplane (right) is not an original but a replica built by Harry Provost, of Sunland, Calif. It took about a year to build and has flown more than 25 hr. to date.



FAIR CHILD OF FRIENDSHIP.—American-Dutch collaboration in development of the Fokker F-27 has brought this twin-Dart aircraft into service more quickly than Dutch effort alone could have achieved, and has given Fairchild Aircraft an entry into the commercial aircraft market. Seen here are the third (below, left) and fourth (above) Fairchild F-27s, respectively for West Coast Airlines and Piedmont; and the cockpit (left) and the 36-seat interior (below) of the Piedmont F-27.

Private Flying

THIS YEAR'S MILWAUKEE FLY-IN

By Bob Whittier

THE SUGGESTION of holding the Sixth Annual National Fly-in of the Experimental Aircraft Association early in August, instead of late in the month as had been done previously, paid off handsomely in the form of excellent midsummer weather. Clear blue skies before and during the Milwaukee, Wisconsin, event brought in a record number of aircraft and people, and the programme ran well.

The three-day meeting on August 8, 9 and 10 drew a crowd of about 30,000, including several hundred E.A.A. members. More than 250 visiting civil aeroplanes were counted on the field, and about 60 home-builts were on hand. To cite a few of the E.A.A. members present, there was Jan Christie, a S.A.S. pilot from Oslo, Norway, and S/Sgt. Thomas Atkinson of Fairbanks, Alaska, and Don Simmons of Moncton, N.B., Canada. Nearly every State in the Union was represented, and the trophy for the amateur-built aircraft flying the greatest distance to attend went to Victor G. Wendt, who had flown his Baby Ace 1,650 miles from Opa Locka, Florida.

Friday saw the Fly-in committee very busy indeed directing incoming aircraft to parking areas, registering members, and planning events. An excellent buffet supper was served, after which the president, Paul Poberezny, got the meeting officially under way with a welcoming speech. In it he remarked about the growth of E.A.A., and some of his statements will be of interest.

The men who formed the Association as a local group in 1953 never dreamed it would grow as it has. Initial impetus to nationwide growth was given by a photo-story of home-built 'planes by Leo Kohn in *Mechanix Illustrated*. This brought inquiries from numerous aircraft mechanics, pilots, and men who had been active in sportflying before the Second World War. At that time the Association's magazine, *Experimenter*, consisted of a two-page mimeographed newsletter to which were stapled a few photos.

Judges scrutinizing a Baby Ace. At the far end of the line can just be discerned a privately owned P-51 Mustang.

Since then E.A.A. has received an ever-increasing amount of national and international publicity in a variety of publications. Membership is now crowding the 4,000 mark, and Mr. Poberezny stated that an average of 75 letters a day come to his mail box.

Voluntary Organization

The work of administering this burgeoning organization is handled on a voluntary basis in their spare time by Poberezny and his wife, who devote three-quarters of their basement to an office. A like amount of space is used in the home of Secretary-Treasurer Bob Nolinske, who is assisted by his wife. Smaller amounts of space are used in the home of art director Wes Schmid, whose wife handles the work of keeping in touch with the group's 46 chapters, and in the home of George Hardie, who is Managing Editor for the Association's magazine, *Sport Aviation and Experimenter*. The time is coming when E.A.A. must find a way to maintain a full-time office staff.

Poberezny went on to discuss other aspects of the growth of interest in amateur aircraft, such as the fact that E.A.A. is now affiliated in one way or another with similar groups in Canada, England, France, Australia, New Zealand, and South Africa. The safety record of home-built 'planes in the U.S. continues to be very good, the C.A.A. extends its valuable interest and co-operation, and discussions are constantly going on relative to simplifying and improving various aspects of the Civil Air Regulations as they affect amateur-built machines.

A petition was signed by members asking the C.A.A. to remove amateur-builts from the "Experimental" category, which also includes huge military and transport aircraft prototypes. Crashes involving the latter have created public agitation for strict control over the flight of "Experimental" aircraft, to the embarrassment and concern of those who flit about in ultra-lights of their own construction. A new "Sport" category is sought.

Lights were then extinguished and a motion picture was shown by the Goodyear Company. It featured the collapsible aeroplane made of rubberized fabric by that firm for the U.S. Navy, and showed an airman in flying suit and crash helmet matter-of-factly trundling a large bundle into a clearing on a two-wheeled cart.

The airman went about a mysterious routine of unrolling and unfolding a shapeless mass of fabric and attaching to it a power pod. An air line was then plugged in and slowly, with intermittent jerks, heaves and thrusts, the shapeless mass took the form of an aeroplane as the airman fussed about it, prodding and pulling at kinks. The pilot then "propped" the tiny engine, climbed in, and soared away into the blue sky.

Another film was shown by a Californian who, at the claimed cost of $250,000, had built and flown a home-built jet aircraft a few years back. Then came the time for Dr. August Raspet's annual lecture, complete with blackboard diagrams. Again there was much talk about boundary-layer control and improved efficiency for small aircraft.

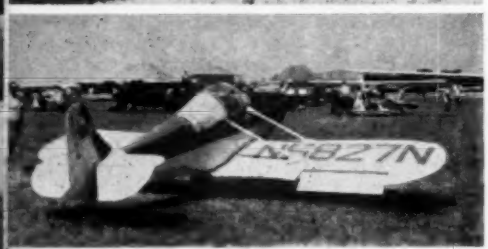
Saturday's Events

The sky was clear on Saturday, but the thermometer soared to 95° F. before the day ended. Benefiting from previous years' experience, judges for the flight, design and workmanship competitions went about their jobs with aplomb.

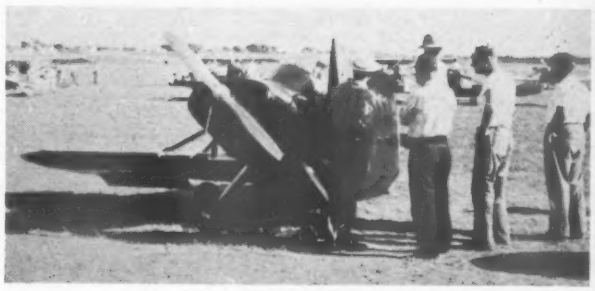
The public was admitted to the aeroplane parking area in keeping with E.A.A.'s policy of furthering airmindedness and aviation education, and "cockpit-leaning" was the order of the day. Many persons lined the taxi-ways to see the take-off and landing of the aircraft competing in spot-landing, acceleration, slow-flying, and short take-off competitions. It was most interesting to see first a big-winged Pietenpol rise and descend with the deliberation of a condor, then watch a Baby Ace perform as jauntily as a sparrow, to be followed by a Wittman Tailwind . . . which, by contrast, seemed like a confused mallard landing on an iced-over lake while going downwind in a gale!

The Antique Aircraft Association was represented by several machines, and its president, Bob Taylor, of Ottumwa, Iowa, had a booth in one of the hangars. On hand was a 1933 Aeronca C-3, a 1929 Travel Air,

(*Continued on page* 449)



Left, top to bottom, the "Head Skinner," based on Luscombe components; R. Benckendorf's Stits Playboy; a beautifully restored Great Lakes Sports with 145-h.p. Warner engine in a very neat cowling and fairing.



Above, left, the Stits Playboy, with folded wings, made by James Frost, of Tulsa, Okla. It attracted much attention. Right, the Kerestesi Special is an example of the tendency in the U.S. to build small, fast monoplanes.

(*Continued from page* 448)

a 1930 Great Lakes, a 1932 Fairchild two-seat "24," a 1934 Ford-powered Pietenpol, a 1930-era Franklin Sport, a beautiful 1937 Ryan STA, and others.

Last year we were treated to two species of the Moth family, but this year there was none. De Havillands did, however, manage to make their existence known by the appearance of a U.S. Army Beaver, an executive Dove and, being overhauled in the airport's shops, a Vampire which had found its way into the hands of a Milwaukee sportsman.

The static exhibits in the hangars were most interesting. A large table was spread

Top, Donald Nordsving's Pietenpol competing in the spot-landing contest. Lower, the incomplete Pietenpol of Marion McClure gets a careful scrutiny by E.A.A. members in the display hangar.

with sample blueprint sets for several popular amateur aircraft, and these received a most careful study by interested persons. An assortment of structural components had been obtained from an Air Force museum storehouse in Illinois and were on view; notable was a section of the spruce-and-plywood fuselage of the Sperry Messenger light aircraft of the 1920s. Mr. Victor Lorenz, of Milwaukee, displayed his incomplete all-metal sportplane, and nearby Mr. Jim Graham, of Detroit, had set up a portable air compressor, riveting gun and collection of forming tools and dies. Between them these two gentlemen explained away many a mystery surrounding all-metal sportplane construction and doubtless sparked new interest in this material.

From Bloomington, Illinois, Mr. Marion McClure trucked the fuselage, tailfeathers and Ford A engine of an incompleted Pietenpol. The all-wood fuselage of this design dates from the early 1930s, but in spite of that, many men, on having this opportunity to inspect the uncovered framework, were deeply impressed with its intrinsic simplicity and sturdiness. Allen Rudolph's 1934 Pietenpol, from Juneau, Wisconsin, sitting out there on the field, further testified to the durability and reliability of a well-designed wooden fuselage.

Baby Aces in some variety were on hand. One had cut-down Luscombe wings, another had shortened Piper Cub wings, and various other modifications were to be seen. Ace Aircraft, of West Bend, Wisconsin, displayed a cleaned-up version of this design now offered in kit form. A four-place, tricycle-geared ship by Leon Davis, of Lake Village, Indiana, was unique and won the Outstanding Design Trophy. It featured simplified all-metal construction characterized by a fuselage of all-flat surfaces varying from square section in the front to octagonal at the tail. It had a flying butterfly empennage.

Small and Hot

However, I noted that the majority of aircraft on hand were rather small "hot" single-seaters, and it was something of a disappointment not to see anything new in the way of single- and two-seaters suitable for the inexperienced pilot. Such things take time, of course, and if all the talk may be believed, some interesting designs are coming.

A presentation ceremony was held on Saturday for the many trophies covering such things as workmanship, design, flight performance contests, best Baby Aces, best Stits Playboys, best antique restorations, and so on. Readers of THE AEROPLANE will be happy to learn that an E.A.A. award for Exceptional Contribution to the Homebuilt Aircraft Movement was presented, *in absentia*, to Mr. Arthur Ord-Hume, of the Isle of Wight, in recognition of the articles on European developments and techniques he had done for *Sport Aviation*. A similar award went to Georges Jaquemin, of Streetsville, Ontario.

Then the annual meeting was held, at which the organization's status was reviewed, followed by an election of officers. All incumbents were returned to their posts. A conference was called of persons interested in E.A.A.'s Design Contest, scheduled to be judged at the 1959 Fly-in. The contest committee felt that, for the contest to serve its purpose, a minimum of 10 entries must be assured. At present it is not certain if that number will have been adequately tested and developed in the coming 12 months, so it was decided to wait until next January before deciding definitely whether to schedule it as planned or postpone it until 1960. Thus far, interested persons have contributed some $1,600 of the desired $5,000 prize money.

On Sunday morning "free time" was declared for visiting and talking among members and 'plane owners, and by mid-afternoon most of the participating machines had left for their homeward flights.

AIRCRAFT AT THE E.A.A. FLY-IN

Stevens Special, N7609B, Robert Stevens, Wichita, Kan.; Baby Ace, N10443, Leroy Huff, Oklahoma City, Okla.; Miller Twin, N9074C, Irv. Miller, Milwaukee, Wis.; Baby Ace, N75H, E. Hepler, Rochester, N.Y.; Little Pink Cloud, N39B, Owen Billman, Mayfield, N.Y.; Sablar Special, N2747A, Tony Sablar, New Philadelphia, Ohio; Pietenpol, N5452N, Donald Nordsving, Canton, Minn.; June Bug, N35K, Ray Hegy, Midland, Texas; Bryan II, N2714C, Leland Bryan, Milford, Mich.; Davis, N5822N, Leon Davis, Lake Village, Ind.; Head Skinner, N7934A, Jerry and Earl Adkisson, Tuscola, Ill.; Pete Myers Spl., N42963, Pete Myers, Oaklawn, Ill.; Baby Ace, N5824N, Jesse Ross, Fremont, Ind.; Stits Playboy, N5827N, R. Benckendorf, Streator, Ill.; Super Dart, N15N, Jack McRae, Hempstead, N.Y.; Golden Bullet, N9090C, Myrle Replogle, Osceola, Ind.; The Texan, N47F, Sim Paine, Booker, Tex.; Baby Ace, N5244N, Encel Kleier, Inala, Okla.; Stits Playboy, N434K, James Frost, Tulsa, Okla.; Kadiak Speedster, N41C, Bob Horne, Huntsville, Ala.; Bee Dee M-4, N40001, B. D. Maule, Napoleon, Mich.; Baby Ace, N7625B, Gerald Young, Viola, Ill.; Little Monster, N2752C, Chas. Wood, Clay Center, Kan.; Rice Spl. (3rd), N691, J. T. Miller, Van Wert, Ohio; Rice Spl. (1st), N64576, E. L. Bates, Van Wert, Ohio; Baby Ace, N10150, Bob Ambriole, Fort Wayne, Ind.; Zehr Spl., N69973, Lester Zehr, Jr., Fort Wayne, Ind.; Baby Ace, N5510A, Victor Wendt, Miami, Fla.; Stits Playboy, CF-RAD, K. Hopkinson, Goderich, Ont.; Stits Playboy, N96J, Don Steele, West Unity, Ohio; Mong Sport, N4906E, Archiel Yarger, Angola, Ind.; Little Devil, N3870C, Carl Peterburg, Milwaukee, Wis.; Kerestesi Spl., N535, Chas. Kerestesi, Elgin, Ill.; Baby Ace, N6887D, Ray Goss, West Bend, Wis.; High Tow, N2840C, Ken Flaglor, Des Plaines, Ill.; Tailwind, N100G, Sundby and Amundson, Stoughton, Wis.; Baby Ace, N9050C, Jack Cornes, Highland Park, Ill.; Tailwind, S. J. Wittman, Oshkosh, Wis.; Baby Ace, N6066Y, Marvin Smith, Chicago, Ill.; Sackett Spl., N33130, Horace Sackett, Gobles, Mich.; Tailwind, N223A, Ed Todd, Madison, Wis.; Rose Parakeet, Bob Carey; Pietenpol, N13691, Allen Rudolph, Jineau, Wis.

The Stevens Special, by Robert Stevens, is a modified Baby Ace using Luscombe wings.

Private Flying

H.J.C.'s CLUB COMMENTARY

● ON SUNDAY next, September 14, the **Vickers Flying Club** is holding a competition for the Pilots and Navigators Cup, and members of the club have challenged the **Fair Oaks Aero Club** to take part, on an inter-club basis, for a special trophy. The total points of the 10 best teams (of two each) from each club will decide the result.

The contest will be flown at Fair Oaks aerodrome.

● SEPTEMBER 27 has been selected for the Fair Oaks club's "At Home" day. The "Fair Oaks Cup" will be contested, and Esso Petroleum has put up a special prize, which will be presented by the company's aviation manager, Mr. D. C. Ward-Campbell.

Another function to be held at Fair Oaks is the annual dinner-dance—on October 17.

P.P.L.s have recently been gained by Messrs. Barrio, Pelham, Hedley, Rogers, Moore, Davey and Edgar, and by A.T.C. cadets Charlton, Harwood and Joy. Members making their first solos recently were Messrs. White, Nunn, Martin, Murgatroyd, Bainbridge and Blacklock and Cdts. Priest and Voice.

● IN JULY the **Lancashire Aero Club** flew a total of 255 hr. 45 min., only a little below the corresponding figure for July, 1957—259 hr.—despite the unkind flying weather from which all clubs have suffered this "summer." But the June-July total was only 396 hr.

A.T.C. cadets Harrop and Jones and Mr. Scarlett have now flown solo, and Mr. Laird has obtained his P.P.L.

● AT THE rally of the **Handley Page Flying Club** at Woodley, Reading, on August 23, Mr. C. H. Cosmelli, a member of the **Denham Flying Club**, won the cup for the best all-round performance in the navigation, spot-landing and flour-bombing competitions. Mr. R. Williams, one of the organizers, won a cup in the team award flying one of Denham club's aircraft.

● PUBLICITY by the **Aircraft Owners and Pilots Association**, of Washington, D.C., states that private flying in the U.S.A., meaning all civil flying except that of the scheduled airlines, is a prospering business; and from the figures below we are prepared to believe it.

A survey recently completed by the Association's official magazine, *The AOPA Pilot*, shows that "general aviation" aircraft outnumber airline aircraft by more than 50 to one, and comprise 97.1% of all U.S. civil aircraft. The Association, claimed as the World's largest organization of its kind, has some 70,000 members.

Members fly a total of 12,685 company-owned aircraft, and an additional 40,540 aircraft are privately owned. Of the former 8,600 aircraft are single-engined, and 4,085 multi-engined. Single-engined privately owned aircraft total 37,494, and there are 2,026 multi-engined. (What the balance of 1,020 are is not stated.) The average maintenance cost per aircraft per year is $1,750.

Photograph copyright "The Aeroplane"

LINNET TEST FLYING.—Sqn. Ldr. Neville Duke, in cockpit, is to test-fly the Garland-Bianchi Linnet at Fair Oaks. On the nearside wing is Mr. Doug. Bianchi.

Gliding Notes

by Dr. A. E. Slater

TERLET, a few miles north of Arnhem, is the national gliding centre of the Netherlands. From Amsterdam it is a two-hour journey by rail and road, so there was just time, on the final day of the Astronautical Congress, to fit in a short visit to it between the last scientific paper and the farewell dinner.

The site is on a heath in undulating country, with sandy soil, and obviously at a higher level than the damper parts of Holland; thermals appear when cumulus clouds are present, but "dry" thermals are less frequent, I learnt from Mr. O. M. van den Akker, who kindly showed me round.

The first objects we saw in the hangar were two Goevier side-by-side two-seaters with orange canopies, in which blind-flying pupils wear blue glasses to make everything outside invisible. There are 10 other Goeviers, from which ordinary pupils proceed to Grunau Babies for their first solos. They were acquired soon after the War, but now the Centre is building up a fleet of Rhönlerches, in which seating is in tandem, and pupils training in these do their first solo sitting in the front seat.

It was a hot, humid and hazy day, and a Skylark 2 and Skylark 3 were waiting at the starting point in the hope that they would earn Gold "C" and Diamond heights for someone if thunderstorms appeared, but none did.

With Mr. P. Seton, who was instructor for the week-end, I was winched up in a Rhönlerche into the thick haze, where the horizon and most of the landscape disappeared, so that, as he said, one had to "fly by feel." This was no problem with the Rhönlerche; its controls are well co-ordinated and all equally sensitive, so that one gets the impression that the elevator control is considerably geared down. Like the Olympia, it feels and sounds much the same over a wide range of speeds.

* * *

"What did you do wrong?" asked Mr. Seton. But the answer was already obvious because, on the approach, he seized the controls and performed a sharp S-turn which put us down at least 100 yd. from the two Skylarks. These, he explained, were the Centre's most valuable assets and I was about to land within 50 yd. of them. The Skylark 3, by the way, had flown at St. Yan, and the Centre also possesses the Sky which Philip Wills flew to victory in 1952.

An instruction course of 44 pupils aged between 16 and 18, who were preparing the clubhouse for a farewell party, had just ended. Such pupils get free flying but pay for their board and lodging. The object of the course is to find out if they are temperamentally and physically suited to aviation; if they are, they are helped to go into it professionally.

For aero-tows, Tiger Moths are lent by the Air Force. All the gliders in Holland, except six in private ownership, are owned by the Royal Netherlands Aero Club.

The standard two-drum winch in Holland is the "Wyz"; any gliding club can hire one for 500 guilders (about £48) a year, and if it is still undamaged after 10 years, the club can keep it for good. Terlet has a spacious workshop, with a dust-free room attached. In another room is a Link trainer, in which "thermals" can be laid on by the instructor.

* * *

The previous evening had been spent enjoying hospitality from the De Boer family, of whom Ilbert has flown in World Championships and his wife Ans has been team manager four times in succession. They fly at the Amsterdam gliding club, which operates on a large aerodrome at Soesterberg, where the National Aeromedical Centre is established. The club fleet consists of two Sedberghs, a Rhönlerche, a Prefect and two Grunau Babies, one built in Holland and the other in Germany. It also owned a Skylark, but, during a recent expedition to Terlet, this machine unfortunately lost part of a wing in a collision with the Prefect, and spun in. The Prefect, in spite of a severed lower longeron and a badly damaged wing, got down safely. It happened in a thermal which was large enough for the two machines to occupy separate circles which, however, touched at one point; they were circling in opposite directions.

UNDER COVER.—Sheltering from rain under the wing of a sailplane during an A.T.C. gliding course at White Waltham are, left to right, Cdt. Sgt. David Farmer (Eton C.C.F.); Cdt. Timothy Gauvain (Stowe College C.C.F.), and Cdt. Benedick Pease (Eton C.C.F.)

Correspondence

R.34 Memorial

THE original proposal for commemoration of the first double aerial crossing of the Atlantic by the officers and crew of H.M.A.R.34 in July, 1919, was made by the undersigned in a lecture to the Glasgow Branch, the Royal Aeronautical Society, in September, 1949. *The Times* kindly published letters from the writer to this end in that year, and again in 1954. It was through this latter letter that the Air League decided to take the matter up.

I had made representations to the Council of the Royal Aeronautical Society from time to time, but the Council intimated, that while they were in favour, other commitments precluded them from activity in the matter. I was glad, therefore, when the Air League decided to sponsor the memorials. From correspondence available to him, Mr. Sabin will be aware that the help I have rendered the League in the proposal is of some significance.

Memorials to the officers and crew of H.M.A.R.34 are not a matter for the Air League alone, for the brave feat performed by these men is peculiarly a part of Britain's story, for to fly the 6,000 miles of the non-meteorologically unknown wastes of the Atlantic in an airship, which had never been proved, and for which no knowledge of aerodynamically caused stresses existed, is the sort of thing only Britons would attempt and carry through successfully.

Since, therefore, these memorials are a national matter, the League is to be criticized in that the profile of R.34 depicted on the plaque at East Fortune is incorrect. The forebody of R.34 was an exceptionally good aerodynamic form; that depicted on the plaque is ugly and non-aerodynamic.

Had the League consulted those well able to advise them on the form of the hull, they would not have perpetuated a distortion of a very shapely form which aerodynamically made the flights possible. Had R.34 been shaped as shown on the East Fortune plaque, her resistance would have been too great for her to have made the outward voyage.

As so often, one error, having been made, becomes the begetter of worse evils. The Air League states "Mr. Lynn Chadwick . . . at once realized that nature has no parallel to the lighter-than-air principle and that no ready-made symbol . . . was to be sought." He failed to realize that an airship, if not flown lighter than air, is not flown buoyantly but aerodynamically.

In fact, R.34 made both her voyages aerodynamically, but gas lift neutralized only part of her weight. An airship depends more on her aerodynamic lift for flight than upon her gas lift. Without aerodynamic lift, airship flight would be impossible. The hull and fins of an airship are her wings, equally essential to her as wings to aeroplanes or birds.

Just as the plaque at East Fortune perpetuates ignorance as to the form of R.34, so the proposed memorial at London Airport will perpetuate ignorance as to the principles of airship flight. Art, if it is Art, is an expression of Truth.

I, therefore, object to Mr. Chadwick's design on the grounds that it falls short of Art as far as ignorance falls short of Truth.

Dumbarton. W. NEWMAN ALCOCK.
(Hon. Sec., Glasgow Branch, the Royal Aeronautical Society; Hon. Sec., the Federation of Engineering Societies in Glasgow.)

Honour the Brave

THERE are two items in your issue of August 8 which concern early aviation history on which I would like to make two comments.

The first is the picture of the commemorative tablet to Wilbur Wright's first public flight in Europe. This, I think, is related to the current controversy on the proposed R.34 Memorial.

Is not the basic trouble over the R.34 affair that the Air League commissioned a "work of art" whereas the critics of this work of art want something which can enlighten and interest the hurrying modern air traveller who has never heard of the achievement, and who will be very interested when he does hear of it, and will want to know what R.34 looked like, her size, power and other relevant details? Would not something (say a low-relief mural of R.34 nosing her way through clouds, with some information below it) on the lines of the Le Mans memorial be a far better answer than a "work of art"?

Even the Venus de Milo, if set up at a busy airport, would raise or satisfy little curiosity because the subject matter is a well-known streamlined body in everyday use. The R.34 is not so well known and the great achievement of her crew is completely unheard of today.

The second point is raised by Professor Richards' excellent letter (THE AEROPLANE, August 8) on the first flights. To me, and to others I expect, there is something rather distasteful about the scientific attempts to show all the possible ways in which these very determined, very enthusiastic and rather brave men were wrong when they believed they were flying. They were doing something others had not the vision to attempt and they and their eye-witnesses believed they had done it.

They were not showing off under a battery of television cameras and *for all we know now* (in our absence of data regarding weather, ground surface and the momentary tune of their erratic motors) they *were* truly flying. Unquestionably the ones we are arguing about (Roe, Cody, Farman) flew "properly" and to no mean tune very shortly afterwards. Also Roe and Farman founded great aircraft concerns.

All are now dead and I for one would like to see any memorial which happens to have been erected on the site of their achievements left as it was and more tolerance shown in a subject about which there must always be an element of uncertainty.

East Anglia. "SOLDIER-AIRMAN."

Re B.O.A.C. Annual Accounts

BEFORE condemning B.O.A.C. for showing a deficit during 1957, I think that it should be more widely known that we are having to face unnecessary competition across the Atlantic.

In all there are 12 scheduled transatlantic carriers operating between Europe and U.S.A. No less than seven of these enjoy rights enabling them to pick up or deliver passengers between the U.K. and U.S.A.

I regard Pan-American and T.W.A. as legitimate competition, but view El Al (out of London), Sabena (ex Manchester), K.L.M. and S.A.S. (ex Prestwick) in a different light. These four "pirate" carriers between them carried a total of 38,289 U.K.-U.S.A. passengers during the year ending 1957.

In terms of revenue this amounted to $12,431,540. I use the dollar denomination deliberately as the bulk of the transatlantic tourist trade originates in the U.S.A.

These foreign carriers are permitted to purloin our most lucrative passenger market by Government agreement. Why? Certainly we receive no reciprocating benefits of equal value.

I know that we live in an era in which the give-away programme is an ever-popular attraction but—really—$12,000,000 seems a bit steep.

Berks. A. SPOONER.

"He's not airsick. He was just talking to a passenger in Economy Class and now he's figured out how much his complementary dinner, drinks and eight hours in this De Luxe Class, fully reclining seat, are costing him!"

NOTES AND EVENTS

"THE AEROPLANE" INDEX

NOW available is the index to THE AEROPLANE, Volume 94 (January-June, 1958). Copies can be obtained on receipt of 4d. to cover packing and postage. Applications should be made to Temple Press Limited, Bowling Green Lane, London, E.C.1.

RADAR ORDER.—As part of the NATO infrastructure programme, about £1 million worth of radar equipment has been ordered from Marconi's Wireless Telegraph Co., Ltd., by the Norwegian Ministry of Defence. The order includes two control and reporting stations, each of high-power and long-range. The stations will be radomed. The Marconi transmitters are newly developed high-power equipments which are completely self-contained and are designed for unattended operation having full remote-control facilities.

LONDON SHOWROOM.—Esavian, Ltd., of Stevenage, Herts, has opened a new showroom at 185 Tottenham Court Road, London, W.1, under the management of Mr. A. E. Grice.

MISSILE HEAD.—Synthetic resins by Bakelite, Ltd., are used in the construction of the nose cone of the English Electric Thunderbird. The cone is produced on a metal mould over which are drawn specially knitted glass-fibre "stockings." The picture shows a rubber resin trough being filled with a cold-setting resin mix before the resin is drawn to the sight glass at the top of the mould by vacuum.

FIRST ROUND-UP.—Aircraft are being used for the first time in Africa to search for and round up animals in an operation for the Game and Fisheries Department to catch zebra, eland, etc., to prevent their threatened extinction by tsetse fly. Two aircraft took off from an airstrip at Ankole, in the Western Province of Uganda, bordering on the Congo, on August 18. Not only are they being used for reconnaissance but will drive the game towards specially built compounds.

KENT EXHIBITION.—The mobile exhibition of George Kent, Ltd., of Luton, has started on another tour of Europe and Scandinavia. Now fitted with the latest electronic developments in industrial instrumentation, it will visit Sweden, Norway, Denmark, Poland, Belgium and East and West Germany. It returns to this country early in December.

U.K. AGENT.—The Elgar Machine Tool Co., Ltd., has been appointed exclusive distributor in the United Kingdom for the range of vertical and horizontal bandsawing and filing machines made by its principals, August Mossner, of Schwabisch, Germany.

METAL BONDING.—A technical information sheet on high-temperature adhesives for metal-to-metal bonding in aircraft construction has been published by CIBA (A.R.L.), Ltd., of Duxford, Cambridge.

BRITISH STANDARD.—A new British Standard, "Flexible corrugated oxygen tubes for aircraft" (B.S.F65:1958), is now available from the sales branch, British Standards Institution, 2 Park Street, London, W.1, price 2s. 6d.

AIR LAW TUITION.—The 1958-59 University College London courses on International and Comparative Air Law for non-degree students begin in October. Two courses on this subject are to be held by the College's Faculty of Laws, the first dealing with the General Principles of International and Comparative Air Law and the second covering selected problems of the subject on a more advanced level. Each course consists of a weekly 1½-hr. lecture. The fee for each of the two courses is £6 per session and the registration fee on the first admission is 10s. Application forms, syllabuses and more detailed information can be obtained from the Faculty of Laws Office, University College London, Gower Street, London, W.C.1.

Aviation Calendar

September 12-22.—Aeronautical Pentathlon and Air Rally at **Liège**, Belgium.
September 15-21.—Battle of Britain Week.
September 20.—Aviation Forum of London annual dinner, at the Aerodrome Hotel, **Croydon**, Surrey.
September 21.—Sailplane aerobatic competition organized by the London Gliding Club, at **Dunstable**, Beds.
September 21.—Air Rally organized by the Milan Aero Club, at **Milan.**
September 21.—Royal Belgian Aero Club international concourse for balloons, **Brussels.**
September 21.—Denham Flying Club garden party, at 14.30 hrs.
September 24.—R.Ae.S. Manchester Branch lecture, "Why Airlines are Hard to Please," by B. S. Shenstone, M.Sc., F.R.Ae.S., A.F.I.Ae.S. (B.E.A.), in the Reynolds Hall, College of Technology, **Manchester**, at 19.30 hrs.
September 25.—R.Ae.S. Graduates and Students Section lecture, "The Next Generation of Civil Aircraft," by G. H. Lee (Handley Page, Ltd.), in the Library, 4 Hamilton Place, **London**, W.1, at 19.30 hrs.
September 25-26.—Aerodrome Owners Association annual conference, at the Hyde Park Hotel, **London**, W.1.
September 26-29.—Austrian Aero Club Rally at **Innsbruck.**
September 27-28.—"Tipsy Week-end" organized by the A.S. Flying Club, at Baginton Airport, **Covenfry.**
October 4.—Aviation Forum of London lecture, "The Channel Air Bridge," by Douglas Whybrow, at the Imperial Hotel, Elizabeth Street, Victoria, **London**, S.W.1, at 19.00 hrs.
October 8.—R.Ae.S. Manchester Branch lecture, "Some Problems of Supersonic Flight," by L. P. Twiss, O.B.E., D.S.C., A.F.R.Ae.S. (Fairey Aviation Co.), in the Reynolds Hall, College of Technology, **Manchester**, at 19.30 hrs.
October 9.—Society of Instrument Technology, Control Section lecture, "Aircraft Flight Simulators," by Dr. A. E. Cutler, B.Sc., Ph.D., at Mansion House, Portland Place, **London**, W.1, at 17.30 hrs.
October 16.—R.Ae.S. Graduates and Students Section lecture, "The Fatigue of Aircraft," by Maj. P. L. Teed (Vickers-Armstrongs), in the Library, 4 Hamilton Place, **London**, W.1, at 19.30 hrs.
October 21.—R.Ae.S. Luton Branch lecture, "Fatigue Testing of the Fokker Friendship," by E. J. van Beek (Fokker), in the Napier senior staff canteen, **Luton Airport**, at 18.15 hrs.
October 23-24.—GATCO Convention at **Southend-on-Sea**, Essex.
October 29.—R.Ae.S. Graduates and Students section, film show, in the Library, 4 Hamilton Place, **London**, W.1, at 19.30 hrs.

SURVEY FILM PRINTER.—A new continuous film printer for 35-mm. or 70-mm. negative film has been designed by Fairey Air Surveys, Ltd. Printing lengths of up to 100 ft. at a constant speed of 9 ft./min., the equipment is being marketed for printing record traces and aerial films and for producing duplicated negatives by using positive stock. It has been ordered by the Ministry of Supply for the R.A.F.

Company Notices

NEW COMPANIES

Air Links, Ltd. (610,061).—Private co. Reg. Aug. 21. Cap. £100 in £1 shs. Objects: To establish and operate an air transport undertaking for the carriage of passengers, goods and freight of all kinds, etc. First directors not named. Solrs.: Sykes and Co., Croydon.

Aircraft Production Tooling Co., Ltd. (610,060).—Private co. Reg. Aug. 21. Cap. £1,000 in £1 shs. Objects: To carry on the business of machinery, tool and pattern designers, and as mechanical and general engineers, etc. Directors: Norman J. Blunt and Mrs. Pamela A. Blunt, both of Timberley, Hillside Rd., Ashtead, Surrey. Sec.: N. J. Blunt. Reg. off.: 5 Barnett Wood Lane, Leatherhead, Surrey.

Newtonair, Ltd. (610,105).—Private co. Reg. Aug. 22. Cap. £5,000 in £1 shs. Objects: To carry on the business of manufacturers, designers, repairers, storers and distributors of and dealers in aircraft and other rockets and missiles of all kinds and all electric, electronic and other components required in connection therewith, etc. Directors: Harry T. Newton and Mrs. Mary Newton, both of Scittlefield, Hookwood, near Horley; and Cyril S. Newton, 1468 Dallas Rd., Victoria, B.C. Sec.: P. W. Smith. Reg. off.: Gatwick Airport, Horley, Surrey.

New Patents

APPLICATIONS ACCEPTED

803,301.—Metzler, E. G., and Curley, M. T.—"Aircraft wing mounting."—Aug. 13, 1956.

803,419.—Ringleb, F. O.—"Boundary layer control."—Nov. 4, 1954. (March 30, 1954.)

Applications open for public inspection will be available on Oct. 22, 1958; opposition period expires on Jan. 22, 1959.

Personal Notices

BIRTHS

Bleach.—On September 1, at R.A.F. Hornchurch, to Cynthia (*née* Evans), wife of Sqn. Ldr. D. G. Bleach—twins, daughter and son.

Blount.—On August 31, at the R.A.F. Hospital, Tengah, Singapore, to Susan (*née* Cobbold), wife of Sqn. Ldr. Christopher Blount—a son.

Brimson.—On August 29, at Gloucester to Delwyn (*née* Morgan), wife of Flt. Lt. I. D. Brimson—a son.

Swalwell.—On September 1, at R.A.F. Hospital Ely, to Gillian (*née* Poole), wife of Flt. Lt. L. C. Swalwell, R.A.F.—a son.

DEATH

Murlis-Green.—On August 26, Gp. Capt. G. W. Murlis-Green, R.A.F. (Retd.), D.S.O. and bar, M.C. and two bars. (Box 230 Kitale, Kenya Colony.)